THE LIFE AND TIME OF ADOLF KUSSMAUL

THEODORE H. BAST

To E. L. Severinghaus
With kind regards
and best wishes
M. H. Bast.

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ADOLF KUSSMAUL

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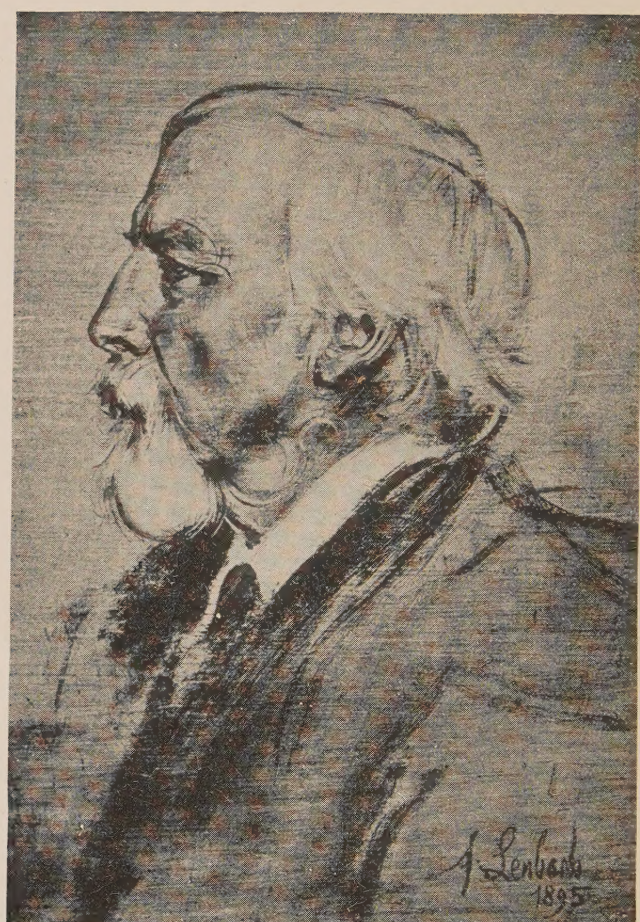

Adolf Kussmaul
(1822-1902)

THE LIFE & TIME OF ADOLF KUSSMAUL

By

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WITH A FOREWORD

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PREFACE

BIOGRAPHIES of great men are always inspiring; many of them, however, are not widely read because they are written in foreign languages. The name of Adolf Kussmaul is well known among English speaking medical men, but the story of his life is little known because the autobiography of his early life and the scattered accounts and references of his later life are almost solely recorded in the German language.

I have consented to publish this sketch of Kussmaul, which was read before the University of Wisconsin Medical History Society, because no extended account of his life has previously appeared in the English language, and because of the desire to present in chronological order the interesting facts about a prominent teacher and physician. The first part is based largely

on Kussmaul's Autobiography. The facts regarding his later life were gleaned from his scientific publications and from a series of articles by his students and other scientists, published in various German periodicals.

I wish also to make acknowledgment for the constructive criticism received from Dr. and Mrs. W. S. Miller and Dr. W. S. Middleton and for the use of Dr. Miller's splendid historical library in preparing this biography.

T. H. Bast.

Madison, Wis.
September, 1926.

FOREWORD

THERE exists a marked difference between an autobiography and a biography. The former deals with facts, incidences, individuals and places, as found, experienced, known and seen by the author himself; the latter is a compilation by another individual who has, as a rule, obtained his information second hand, and who often distorts actualities to suit his or her own ideas of how they should be interpreted.

The two sketches by Adolf Kussmaul, "Jungenerinnerungen eines alten Arztes" and "Aus meiner Dozentenzeit," which form the basis of the following narrative, are exceedingly interesting examples of autobiography, and should be read by every one who is interested in medical biography. The popularity of the former is shown by its having reached its thirteenth

edition, and the latter, though Kussmaul did not live to complete it (it was issued by one of his students after his death), is in its fourth edition.

My own interest in medical biography was aroused by reading, in 1909, a copy of Kussmaul's "Erinnerungen." The fact that it is in the German language has, no doubt, caused it to be little known in this country, except to those American physicians who came in contact with him during his lifetime, or to those who are interested in medical biography.

This sketch of Kussmaul's life in English fills a real need in medical biography. That this particular sketch shall have a kindly reception is vouchsafed by the pleasure its presentation has given the members of the University of Wisconsin Medical History Seminary.

W. S. MILLER.

MADISON, WIS.
September, 1926.

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KUSSMAUL'S TIMES AND FAMILY

DR. ADOLF KUSSMAUL, the student, physician and teacher, painted of the century in which he lived the following most appreciative picture:

I consider myself most lucky to have passed through life as a child of the nineteenth century, since in no other of the innumerable centuries which have passed, has thankfulness been more obligatory. None is comparable with it in enthusiasm and ability to penetrate the secrets of Nature, none has advanced the general welfare and made life more pleasant with the

same measure of inventive spirit, and finally none has scattered more decisively and victoriously the chains of slavery in all parts of the world.

Nature has set the bound of time and space for all things, however; in this country, man entered the titanic struggle with her, with greater determination and succeeded in breaking through the bounds which it set for the senses and bodily energies. Aided by the instruments of science he is now able to master time and space, matter and energy. He separates matter into its elements and forces its atoms to enter new combinations which result in new properties and values. With the spectrum he analyzes the structure of the organic world. Back of the changeable forms of natural forces he recognizes their oneness and uses them as he sees fit. Cunningly he takes the rays of light, laden with power, and penetrates opaque objects. Obediently, warmth and electric current set in motion shovels and wheels. This century has girded the earth with iron rails. With the aid of steam wagons and ships, ways have been opened for free exchange of goods and thoughts. The spoken word passes with the speed of lightning from city to city and from country to

country; written messages speed over countries and oceans—yes, and the phonograph charms the voice of the dead from the depth of the tomb. . . . With a better outlook on life than the theosophy of the past centuries the present century dared to apply the exact sciences for the solution of the problem of creation.

As a science and art, medicine has kept pace with the natural sciences and technical arts. She broke the unnatural alliance which she had formed with speculation, and took her right place among experimental sciences. As a sister to biology she shares the methods and instruments. Rich in inventions and discoveries, she lights up the dark depth of the body recesses. She measures the moving and sensible powers of the nervous system and exposes the murderous enemies, which, unnoticed break forth from their hiding-place to visit individuals and nations with terrible plagues, and attempt to disgrace the skill of the physician, surgeon and obstetrician. No longer is the medical science hopelessly exposed to the poisonous arrows of the gruesome nature which ruthlessly destroys that which it has just created. Medicine has accomplished two triumphs which previous centuries never surmised. She has learned how

to penetrate painlessly the sensitive parts of the body with the knife, and how to preserve the wounds from the pranks of sepsis.

Such expressions are especially significant when made by a man and a member of a family who were so instrumental in lifting the science of medicine to a higher plane.

The Kussmaul Family

According to Dr. Adolf Kussmaul, his family name is of Swabian origin. The originator of the Kussmaul family in the Grand Duchy of Baden was a carpenter by this name, who came from Wurtemberg to the country village of Soellingen near Durlach in 1701. The Kussmauls became a prosperous family in this farming community. The origin of the rather unusual name, Kussmaul, and its original derivation and meaning, have not been definitely ascertained. Translated into English the name means "Kissing mouth." It can readily be understood that such a name might at times cause embarrassment or again amusement, as it actually did to Dr. Adolf

Kussmaul. In 1859, when he was called from Heidelberg to Erlangen, he read a paper at his inauguration entitled "Untersuchungen über das Seelenleben des neugeborenem Menschen." This paper enjoyed great popularity and entered its third edition in 1896, thirty-six years later. However, when this article was presented to a certain prominent woman, who was especially interested along this line, the author's name disturbed her and she is reported to have said: "No! It is impossible. No one can have such a name!" Some years later, however, this same prominent woman did not permit this "impossible name" to stand between her and the much sought medical advice of its bearer.

Kussmaul was not the only name of this type in Baden, as its owner experienced at a dance in Karlsruhe in the winter of 1849–1850. While the dance was in full swing a printed poster suddenly attracted attention. It announced that the gathering was honored by the presence of Mr. Kuss, Mr. Kussmaul, and Miss Küssweider.

On another occasion, while he was in military service, an old colleague of his in Schleswig-Holstein had requested the military physician of the battalion from Baden to stay at his home while in the province. When Kussmaul reported at his home the doctor was out on a call and he reported to the doctor's beautiful wife. At first she did not seem to understand his name and asked him to repeat it. He spelled it for her and thereupon she laughed disconcertingly at him.

At Heidelberg Professor Nägele, whom Kussmaul was assisting, advised him on several occasions to have his name changed because of the embarrassing moments that such a name was bound to bring him at times. Kussmaul, however, did not allow himself to be disturbed thus, but one day dryly ventured the announcement to Professor Nägele:

My family comes from the oldest medical nobility. We are descendants from the great Oribasius, the well-known body physician of Julian. After the death of the Kaiser it is known that this nobleman was banished from

the court and settled with the Goths near the Danube River. Here the name was translated to Kussmaul. *Os*, the mouth, and *Basium*, the kiss, or together *Oribasius*.

Kussmaul relates that this was great food for the humor of Doctor Nägele. At a faculty gathering soon after Nägele made the remark that his assistant was the most aristocratic of all the faculty since he was a direct descendant of the great Oribasius. There was a ripple of laughter but at a wink from Nägele, Dr. Puchelt, who was somewhat of a genealogist, gave the story a plausible aspect and Kussmaul enjoyed greater popularity for a season. The next morning, however, Dr. Puchelt, because of a troubled conscience, wrote a note to Nägele explaining that Oribasius was a Latinized Greek word with a different meaning. He stated that it had nothing to do with mouth and kissing, but was in reality derived from ὄρος, meaning "hill," and βαινω, meaning "I go." A translation of Oribasius according to this interpretation,

therefore, would be "Hillgoer" or possibly "Hillman."

Twenty-five years later Kussmaul read in a book on genealogy, written by Ludwig Steub (Munich, 1870) that his family name was of Old-German origin. According to this interpretation "Kuss" comes from "Kusso" meaning "The Good One" and "Maul" from "Mulo" or "Mutilo" which means "The Energetic One." This Old-German origin Kussmaul felt was correct, especially since certain characteristics, such as long skull, blue eyes and blonde hair, were still retained in his family.

Grandfather and Father Kussmaul

Johann George Kussmaul, the grandfather of Adolf, a *Feldsherer* (army surgeon, one who changes dressings), lived in the little country village of Soellingen, and bore the official title of "Chirurgus." He had the entire medical practice of the village. At that time it was not customary to call a regular physician, who usually lived in a larger city, unless someone was about

to die. Accordingly, a doctor appeared in the village only two or three times a year, and on such occasions there was one question on every lip, "Who is dying?" The grandfather died at the early age of forty. The grandmother, with a family of four, managed to make a living on a small farm.

Adolf's father was born in 1790 and because of his father's early death was forced to assume considerable responsibility about the little farm. He was a thoughtful boy and loved reading. On one occasion the preacher found him reading and memorizing songs while out in the meadow herding the cows. The preacher offered to give him lessons in Latin, an offer which he accepted. His donor then took him to Durlach, where he induced the official surgeon, Kaercher, to give him the necessary training for a medical course. His further studies were carried on in Bruchsal, where he passed his state examination for surgeon (*Wundarzt*) in 1814. He then entered service as military physician. While on a long military march he contracted typhoid fever and was forced

to make his bed in a heap of straw in a military wagon. He recovered without serious consequences. It was customary at the time to confine typhoid fever cases in closed stuffy rooms, and to forbid water as a drink. Wine, on the contrary, was recommended. Because of such treatment typhoid fever was much dreaded and the mortality rate was high. Kussmaul's father concluded that the reason for his uneventful recovery was the open air treatment. In his practice he always advocated fresh air and good drinking water in such cases.

In 1819, after he left the service, he went to Wurzburg, where Schönlein had just made for himself an enviable reputation. Here he studied anatomy under Hesselbach, physiology under Doellinger, and clinical cases under Schönlein. A notebook compiled in Schönlein's Clinic in 1819–1820 is of historical interest. From this it may be deduced that Schönlein did not at that time (1819) teach percussion and auscultation, although in France they had been in use since 1808. Some years later, however, Schönlein gained

great reputation for his new and scientific methods and teachings. In empyema Schönlein had emphasized such uncertain symptoms as numbness of the arm, but not a word about percussion. The majority of the eighty-four cases listed were diagnosed as synocha, febris nervosa, febris gastro-rheumatica, typhus e torpore, lienitis and other terms which were rarely or never used in clinics fifty years later. Schönlein attributed bleeding from the stomach to lienitis. This concept was not changed until Cruveilhier and Rokitansky established that such bleedings were due to stomach ulcers. That much of Schönlein's practice was based on philosophical deductions is shown by the following extract from the notebook:

Liver and spleen are two oppositely placed poles, as are also iron and mercury. Iron is the stiffest and most solid, mercury the softest and most penetrable of all metals. From this a theory regarding the value of iron in diseases of the spleen can be deduced. Just as mercury is helpful in diseases of the liver, so iron is in the diseases of the spleen.

Schönlein's change from such unscientific to scientific thinking must have occurred soon after the compilation of this notebook.

In 1820, father Kussmaul passed his state examination as physician, surgeon and obstetrician (*Arzt*, *Wundarzt*, *Hebartz*). Immediately after his examination he was appointed assistant physician in Graben in the province of Karlsruhe, with the official title of Grand Ducal Staff Surgeon.

In 1821 he married Louise Böhringer, daughter of the owner of the glass factory Buhlbach at Freundenstadt in Wurzburg. He was a very active country physician with a very heavy practice. In the summer of 1850, at the age of sixty, he died from cardiac failure. For thirty years he had suffered irregularities of the pulse without objective symptoms. In later years his pulse became very irregular and this condition was accompanied by periods of dizziness. He confided to his son the belief that his death would come suddenly and requested him to perform an autopsy in such an event. "You do not realize," said he,

"how much your findings will interest me." He died as he had prophesied, and one of his colleagues performed the requested autopsy. The heart muscle was greatly atrophied and had the appearance of pale yellow wax. No other pathological change was noted.

II

BIRTH AND EARLY YEARS

Adolf Kussmaul was born on February 22, 1822. He was the first born in the family and as such received much attention. He weighed six and one-half pounds. Six other children were born into the family. The earliest incident in Dr. Kussmaul's life of which he was cognizant occurred in the kitchen of his home. Unmindful of danger he ran against the legs of the cook just as she was removing a kettle of boiling water from the stove. The cook lost her control and poured part of the water over the youngster's head. He cried furiously and his mother came and took him in her arms. The next scene which he remembered was that of his father leaning over him and examining the damage which had been done. As an objective remembrance of this incident he retained a deep scar on his head which

was covered only by the hair growing around the periphery.

In 1828 the family moved to Boxberg, where young Adolf was to attend the public school. The schoolmaster was an oversized ex-soldier whose sole ambition was to impress upon the youngsters the honor of being a soldier, and the necessity in war, of treating everyone as roughly as possible without respect of person or property. Adolf's father did not permit his son to attend this school very long but obtained a private teacher for him who, too, proved unsatisfactory. His father's practice chanced to take him to a neighboring town where the preacher's wife was dying of consumption. She had taken much snail juice and had slept for some time in the cowbarn, a therapeutic measure which was widely recommended. Adolf's father made the woman's dying moments as comfortable as possible, and as a return favor the preacher offered to give Adolf instruction. It took Adolf about one hour to walk to the preacher's house. However, after a week

or so it took him several hours longer. Nature interested him more than books, and he spent most of the day on the road. The preacher saw that no progress was being made and advised his father to send his son away from home to a private pedagogue. There was no place to go, so the father took the nine year old boy with him on sick calls and also to autopsies. On the way his father taught him *amo, amas, amat*. However, when instead of talking Latin, his father told him the names of birds and flowers, or related incidents from history, he showed much greater interest. This method, however, did not continue long, for the preacher told the father of his son-in-law, who without question would make a good teacher for Adolf. Adolf thereupon was sent to his new teacher, the Reverend Ganz, with whom he remained for two years and from whom he received a training which molded his entire subsequent life.

In the spring of 1833, at the age of eleven, he entered the Gymnasium at Wertheim.

The preacher in whose home he was placed had so many children of his own that Kussmaul received little attention. His whole stay at Wertheim meant little to him. The only incident that interested him in later years happened on the day he stole away to go fishing. One of the group of children who were playing up-stream fell into the river. The rest of the children raised a terrible noise, and frightened, lest the police should come, ran to their hiding places. Adolf saw the child coming down the river. He reached over the edge of the bank, caught its dress as it passed, and pulled it safely to shore. Noting the rescue the other children returned, but Adolf, in turn, fearing the police (a fear which was instilled in every child at an early age) left his fishing equipment and ran to his room as fast as he could. Two things he feared: the wrath of the preacher and the police. The former he received in the form of a lecture. A few days later, while still harboring the fear of the police, a man approached him and said: "Are you the boy who pulled

my child out of the river? I am the foreman of the glass factory and would like to show my appreciation. Kindly take this coin." Bewildered he took it and started to run. After he had gone a short distance he turned to look back and saw the foreman standing at the same spot, looking after him with a pleased but amused smile.

In the spring of 1834, because of his father's transfer to Wiesloch, Adolf entered the Lyceum at Mannheim. Theoretically there was little difference between the Gymnasium of Wertheim and the Lyceum at Mannheim; the former had five grades and the latter six. Practically, however, there was a big difference. The Lyceum of Mannheim had an excellent reputation and her sons spoke of her and her faculty in words of praise only. However, in the best families difficulties will arise. The students, who as a rule were well behaved, could not contain themselves at all times. At times they would spend their superfluous energy on the French professor, who was perfectly helpless when it came to discipline. On one

such occasion, however, he called the Director of the Lyceum, who brought with him the school porter who had charge of the rod. The four worst offenders were called and each received several severe blows on the hand. In spite of such occasional unpleasantries, Kussmaul could not speak highly enough of the fine spirit of the school. He had fallen in love with his work, his fellow students and his inspiring teachers.

When, therefore, the Kussmaul family moved to Heidelberg in 1838 and Adolf had to change to the Lyceum at Heidelberg, he was far from pleased. The faculty and the type of instruction was far inferior to that at Mannheim. The two years which he spent at the "frog-pond," as he called the Lyceum at Heidelberg, he considered as lost. The students were of a rough order and the instruction was carried on in a mechanical way. The professor of Greek and Religion was in the habit of opening his classes with one of two prayers which he used alternately. At the end of the prayer he always turned his face to the ceiling.

One morning as he turned his face upward he saw to his great consternation a paper figure dancing merrily in the air. An investigation was called at once. The culprit was found. The student had tied a string to the paper figure and had fastened a spit-ball to the other end of the string. Shortly before the opening of the lecture he skillfully threw the spitball against the ceiling and the figure began its dance. The student was dismissed.

The students were not all of this type, but there were some very studious individuals who were disliked by the teachers for their greater knowledge. Müller was a good example of this type. "Who starts today," began the Latin professor one morning. "Müller," came the reply from all seats. "Good! Müller, decline *ille!*" "Ille, illa, illud." "Wrong Müller! *vivat sequens!* Fischer, you do it!" "Ille, illa, illum." "*Recte dixisti*, you are right! Down Müller! Up Fischer!" But Müller protested. "Professor, in Zumpt's Grammar it says illud." The Professor looked and saw the word

in the grammar. "Just see that," he corrected himself, "Zumpt really says illud. Then we shall permit mercy to supersede right. Müller you can keep your seat for all I care."

On another occasion the teacher said: "Müller, on which shore of the Euphrates did Babylon lie?" "On the left, Professor." "Fischer, you answer it better!" "On the right." "Good Fischer, move up!" But Müller protested: "Professor, in my book it says Babylon lay on both shores!" "I want to tell you something," retorted the professor, "you are both right. Your Babylon, Müller, lay on the left shore, your Babylon, Fischer, on the right, and my Babylon on the right and left. For God's sake, you can both keep your places."

In 1840 he finished the hated lyceum course and spent a happy vacation studying Nature. He was now entitled to be called *Maulesel*, a term applied to students who had finished their preparatory work but had not as yet entered the University. The meaning of the term is: "No longer a

donkey but not yet a horse." His father gave him preliminary instruction in osteology preparatory to his entrance.

During his vacation one of the first German railroads was officially opened between Mannheim and Heidelberg, September 12, 1840. The following year potato rot occurred in this region and the farmers attributed its cause to the soot from the railway engines. Some years passed before this belief died out. Soon after the official opening, Kussmaul had occasion to travel on it. After the train had started a hat was seen flying through the air and a moment later its owner, a farmer, jumped from the open car after it and landed in the soft sand. The occupants yelled, the train stopped, the farmer raised himself, picked up his hat and unconcernedly entered the train again.

III

THE UNIVERSITY OF HEIDELBERG

In October, 1840, Kussmaul began to attend lectures at the University of Heidelberg. As an innocent freshman (*Fuchs*) he devoted all of his time to his studies. Sharp at 8.00 A.M. he was on his way to Anatomy. In his right hand he held his long smoking pipe which almost reached to the ground. Pipes were smoked by all university students as a sign that they were free students and not members of the despised lyceum. Pipes were used both in the long and in the short style, but freshmen as a rule used the long ones because they could be more easily seen. Smoking did not agree well with Kussmaul but he smoked just the same, because he did not wish to be seen without his pipe. The pipe fad was carried to great extremes at Heidelberg. Pipe specialists, whose speciality it was to carve names and pictures on

the large pipe heads, were in great demand. Pipe cleaners, too, enjoyed popularity. The large pipes needed frequent cleaning and this was not a pleasant task. Even the new pipe-heads were seldom broken in or smoked for the first time by the owner, but this unpleasant task was done by the boot-blacks who cared less for the good nature of their stomachs than for the extra coin in their pockets.

The pipe was not the only new thrill that came to him in the free atmosphere of the new world which he had just entered. There were many old traditions and new ones were continually created by the free student body. The *Fuchsenritt*, the *Fuchsbrennen*, the drinking parties, the fencing, the student songs and the festive oath accompanying the ceremony of piercing the hat, were part of the atmosphere of his new University world. The latter ceremony was accompanied by the following verse:

> Ich durchbohr' den Hut und schwere,
> Halten will ich stets auf Ehre,
> Und ein braver Bursche sein.

Among all of the student activities there was none that received any opposition except the activities of the student fraternal organizations. The energy of these organizations often led to grievous enmities and often to bloodshed among members of different fraternities. So offensive were the consequences at times that the government was forced to place a ban on them, but in spite of this they continued their activities privately, although their colors were no longer displayed publicly.

Just when and where these fraternal organizations originated is not definitely known. However, more than a century before Kussmaul's time poorly organized bodies of this type were in existence. The organizations were provincial in nature. Students from a given province banded together and thus fostered the provincial animosity against other similar bands, which resulted in periodical "paddlings" of a murderous nature. Karl Fredrick introduced very severe measures for curbing these hideous practices and succeeded in

getting a better class of students at Heidelberg. This led to the organization of the *Korps* in place of the provincial groups. They instituted supervised dueling in place of unregulated and merciless paddlings. These organizations were founded on a military basis with free thought as their ideal. The organizations fared well until the revolution of 1830, when because of their free thinking they actively opposed the government. The government again took active measures and many of the members were forced to flee across the border and still others left the University for good. Military fraternities from that time received the anathema of both government and public. Public demonstrations and secret activities speedily resulted in punishment of their partakers. Ten years later, on April 1, 1840, when Kussmaul was finishing his preparatory work, the fraternal organizations proved themselves to have gained a considerable strength. At the funeral of one of their professors the military fraternal organizations arranged

Adolf Kussmaul.

and successfully carried out such an elaborate and pompous procession, in which all non-fraternal students took part, as Heidelberg had never before seen. No punishments followed this public demonstration and activities of the fraternal organizations started anew.

When Kussmaul first entered the University he spent all of his time at his books and had no thought of joining the *Korps*. He, however, enjoyed company, and so it happened that after his first attendance at the Swabian *Korps* meeting he asked for membership in it. In Heidelberg there were eight or ten different organizations in existence, who fostered at all times a mild, and sometimes a severe, antagonism against each other. Since the *Korps* were founded on a military basis, a thorough knowledge of the use of weapons was one of the prerequisites to membership. The foil was the common weapon, although the sword was frequently used. Pistols were used only on rare occasions, usually when non-*Korps* members requested it in the demanded duel.

For months Kussmaul spent three or four evenings of every week on the fencing floor. During the summer of 1841 he passed the requirements and became a member of the Swabian *Korps*. The meetings of the *Korps* were held in a large room which was rented for that purpose. The evening was spent in drinking beer, conversation and fencing. At such meetings the members wore colored bands around their bodies and colored caps upon their heads. The rank of the members was indicated by the number of colors. Those of the highest rank wore three colors and those of the lowest rank only one. The number of fencing contests or duels each had successfully withstood was noted on the bands worn and was also recorded in the membership register. The honor of the *Korps* depended on the fencing and dueling record of its members. A fencing or dueling contest usually took place between members of opposing organizations, occasionally between a member and a non-member and rarely between members of the same *Korps*,

and ended only after one or the other had received a wound. The *Korps* whose member was successful, that is, escaped without injury, received the honor. Members, therefore, were continually on the lookout for the chance to challenge someone to a contest. When this was not forthcoming they would break into the meeting of one of the opposing *Korps* and raise "rough house," which always resulted in the desired contest. Kussmaul must have been in a number of these contests, for he states that all of the older members of his organization had indulged in at least ten or twelve and some in as many as sixty. He speaks of only one fencing wound that he received which became infected. Infections of these wounds were very common, since aseptic methods were not in use at the time. Kussmaul states that Dr. Hofacker, who attended all the contests, reported 20,000 cases in twenty-four years. He published several papers in which he reported his experience with such wounds. He reported success in grafting on noses and lips which

had been cut off. His reports were instrumental in a degree to keep dogs away from the fencing floor, since on one occasion a dog picked up the tip of a nose which had just been cut off and ate it with great relish. Deadly wounds were seldom inflicted, although severe infections often threatened life. Kussmaul reports six pistol duels which occurred during his stay at Heidelberg, only one of which resulted in death.

The senior members constituted a *Korps*-senate or court. They had control over the *Korps* activities and supervised the dueling. In place of the custom of one organization breaking up the meetings of another, which often resulted in grievous scenes, the senate decided to have some occasional frolics to which all *Korps* organizations were invited. These frolics frequently turned out to be drunken brawls. Beer drinking duels became a feature of these evenings. If someone objected to a remark that was made he would challenge the offender to a beer duel. If someone were too noisy he was requested to be silent. If he failed to

heed this request some member whose constitution could withstand a goodly measure of the spirited sap would challenge the offender to a beer duel. Bravely the offender would attempt to drink the potion the challenger had prescribed by example, but in most cases his head would sink on the table in a deep sleep before the task was accomplished.

Near the end of Kussmaul's senior year conditions in the student organizations became so bad that he and several others decided to organize a new fraternal order which was not based on military principles and to which all students were invited irrespective of their fitness to wield a sword. This organization gained rapidly in popularity and soon half of the student body belonged to it. Other organizations of this type arose. Soon the old order broke up and a new order arose whose activities were more humane.

Before I leave the student activities I must mention the experiences which Kussmaul had on a trip which he took during

his vacation in 1842. The money for this trip he had earned by preparing a topographical account of the natural resources in the region about Wiesloch. On the way he stopped at the home of a fraternity brother with whom he spent Sunday. On Monday, when ready to continue his trip on foot into the Schwarzwald, this brother offered to accompany him, which he did. They had hardly started on the trip when his companion asked him how much money he would risk on the gambling machine in the gambling house of Mr. Benazet at Baden. Few excitement-seeking individuals passed through Baden without trying their luck at this game, at which, of course, they were always beaten. Kussmaul asked him how much he would risk and he stated that he would risk just ten florins in order to win sixty florins, so that they could ride to Strassburg in state and eat a fine dinner at the Hôtel de Paris. Kussmaul decided to risk the same amount. On arriving in Baden they wasted no time but went straight to the gambling den. His friend played on

the red color and soon lost all. Kussmaul did not lose heart and played on black and soon won forty florins. He divided with his friend. He further tried his luck and lost all. They then went to a hotel for dinner. After dinner Kussmaul wanted to try his luck again. Before he knew it he had only one thaler left. He turned to his partner and informed him that he would have to pay the return fare as his money was all gone. His partner, however, informed him that he did not have a penny left. Empty-handed and broken-hearted they turned homeward. At several places they asked for a loan, but it was in vain. But finally they arrived at the home of his uncle, who was a druggist, and there they received the necessary funds to see them home.

The Medical Faculty

There was hardly a medical school in Germany whose teachings were as soundly founded on accurate scientific methods as were those of Heidelberg, and only Berlin could boast of a faculty with greater

reputation. Tiedemann, Chelius and Puchelt were hardly the equal of Johannes Müller, Dieffenbach and Schönlein. Nägele, however, as an obstetrician, enjoyed a reputation equal to any of them, and Berlin had made repeated attempts to obtain him. The faculty, consisting of Tiedemann, Nägele, Chelius, Puchelt, Gemelin, Theodore Bischoff and Kobelt, were all old, and so in 1844 the young anatomist Henle and the pathologist, Pfeufer, were added.

Tiedemann was a man of fine stature. He was tall and slender, with a well-proportioned face. As a lecturer he made a pleasing impression. His lectures were well-organized and were read word for word. He never gave illustrations on the board but illustrated his lecture with demonstrations which his attendant, Jacob, brought at the proper moment. One of these demonstrations was to show the rapidity with which certain substances rubbed into the skin are excreted by the kidney. At the opening of the lecture Jacob stood in the background with a small bottle of turpentine. Tiedemann explained

the nature and purpose of the demonstration and at the appointed time Jacob rubbed the turpentine on his hands. He then left the lecture room and in ten minutes returned with the evidence in an open glass dish which was passed from student to student for examination.

In many of the medical schools of Germany, anatomy and surgery were combined in one department with one head, who would unconcernedly step from the dissecting table to the operating table. Tiedemann was the prime mover to have these two departments separated at Heidelberg. At first Tiedemann was in charge of both anatomy and physiology, but during Kussmaul's time Bischoff was physiologist. Tiedemann's anatomical collection and arterial injections enjoyed an extensive reputation. Even the general public found objects of interest in the skeletons of "Schinderhannes" and "Black Peter" which Tiedemann had prepared.

The importance of anatomy he continually held before his students. He advised

them repeatedly to spend their free moments in the dissecting room. "Doctors without anatomy," he said, "are like moles. They work in the dark and the works of their hands are piles of dirt."

Tiedemann's two assistants, Professor Kobelt, the anatomist, and Professor Bischoff, the physiologist, were very antagonistic. They were continually at war with each other. Kobelt was an excellent dissector and had discovered the parovarium, which placed his name in anatomy, but his activities and methods as a teacher did not command the students' respect. Bischoff, likewise, made little impression on his students. The antagonism between the two professors finally reached a climax. Certain students had noted hard white spots on the muscle of a certain cadaver and called Kobelt, who took a part of the tissue to his room to examine. Shortly after Bischoff happened into the dissecting room and the discovery was shown him. He, too, took some of the tissue. Soon after two publications appeared on the subject of calcified

trichina in muscle. The two had independently reached the same conclusion and published their findings without conferring with each other. They carried their fight into the public papers, and the government had to step in and send them to different universities.

With their removal in 1843, Henle was appointed as anatomist at the side of Tiedemann. In 1832 Henle had received his doctor's degree from Bonn under Johannes Müller. When Müller was called to Berlin the following year he took Henle with him as prosector. He entered the field of investigation with such enthusiasm that within a short time he had amassed much new information. Political opposition prevented him from lecturing and after investigation he was sentenced to imprisonment because he belonged to a *Korps* at Bonn. In 1837, through the efforts of Alexander von Humboldt, he was finally permitted to teach at Berlin.

From Berlin he went to Zürich and in 1844, during Kussmaul's last year, he came

to Heidelberg. At Heidelberg he gained unusual popularity. His lectures, illustrated with blackboard drawings, were exceedingly clear and instructive. His unusual enthusiasm for, and his great accomplishments in, research made him an inspiring teacher. His textbook, "Allgemeine Anatomie" (1841), and his "Pathologischen Untersuchungen" (1840) attracted his students. In addition to these attractions his political experience of the past and his student activities as a member of the *Korps*, of which a fencing scar on his left cheek gave evidence, made him the most popular member of the medical faculty.

With Henle a new era started. Medicine was placed on a more rational basis. Henle had coined the term "rational." He and Pfeufer, who came to Heidelberg with him, started a journal in 1843 entitled *Zeitschrift für rationelle Medizin.* Medical practice at the time was largely controlled by philosophy, and the accurate anatomical researches of Henle, based on the cell theory, gave rise to a medical interpretation for

which the term "rational" was well fitted. In 1846 his "Handbuch der rationellen Pathologie" appeared. Older medical men resented the implication in Henle's new term that medicine as practiced was not rational, and tried to urge war on him, however, with no consequence.

As is still customary, and rightly so, certain subjects in natural science were prescribed at Heidelberg and had to be taken by each student who wished to graduate. One of these, organic chemistry, deserves mention because of its professor, Leopold Gemelin, who with Tiedemann had published two volumes on digestion and independently had discovered a test for bile pigment. Another of these prescribed courses was philosophy. Professor Kapp was especially pleased with the large classes which he always had. Kussmaul signed up for the course but because the room was always filled did not attend after the second session. The next semester, when Kapp announced another course, Kussmaul felt himself obliged to express his appreciation by

signing up for it also. He, however, never attended. Through a nephew of Professor Kapp, Kussmaul had become personally acquainted with the old gentleman. When, therefore, at the end of his course Kussmaul called for his grade he was surprised with this remark: "With exceptional industry and great attention."

For centuries the medical instruction at the universities consisted solely of explanations of the works of Hippocrates, Galen and Avicenna. The anatomical reformation of Vesalius in the sixteenth century and the discovery of circulation by Harvey gradually led to systematic research. A systematic clinical instruction was first inaugurated by Boerhaave in Holland early in the eighteenth century. It, however, did not become a universal method until the latter part of the nineteenth century. As early as 1585 the Kurfürst Otto Heinrich advised medical teachers to take their best students along to their medical cases. This, however, was never practiced to any extent. In 1766, Karl Fredrick estab-

lished an obstetrical institute at Mannheim with Franz Anton Mai in charge. When Mai was called to Heidelberg in 1773 he almost at once succeeded in moving the institute to Heidelberg. He further succeeded in obtaining Ackermann as anatomist and surgeon, and Nägele as obstetrician. Thus as early as 1817 Heidelberg had three clinical departments. Franz Karl Nägele was in charge of obstetrics, Maximilian Joseph Chelius of surgery and Puchelt of medicine and pathology. In 1842 a building was obtained for exclusive use by these departments. The clinical instruction, therefore, which Kussmaul received was of such a high order as only few universities in Germany could give.

Only few clinical men could keep pace with Puchelt in general scientific knowledge and literary production. A paper on "Diseases of the Veins" brought him popularity. His main publication, "System of Medicine," in four volumes (1825, 1832, 1835) and many other publications made him a prominent man. Internal medicine as he

taught it was narrowed down to calomel and phlebotomy. The extent of this practice I shall refer to later. In physical diagnosis Puchelt was well trained in the technique of percussion and auscultation. He was able to differentiate between pus and air in the pleural cavity where other signs failed. Percussion and auscultation were practiced by few German physicians at the time. On one occasion he was called to a farmer who was quite ill with some thoracic disturbance. Puchelt made a thorough examination with the aid of a plexor. When he finished the farmer smiled with complete satisfaction and said: "Doctor, your pounding did me much good, when will you come and pound me again?"

All of the patients whose diseases terminated in death were autopsied by Puchelt's assistant. The autopsy was not for the purpose of correcting or affirming the clinical diagnosis, but rather to locate the seat of the diagnosed disease. This method was based on the example of Morgagni. The clinician, thus, did not fear lest the autopsy

would contradict his diagnosis! Diseases were diagnosed according to the symptoms which they exhibited. The common diseases, thus, were dropsy, jaundice, cyanosis, hyperpyrexia, apoplexy, nausea and dysentery. If, therefore, a disease were diagnosed as dropsy and upon autopsy the lungs were badly affected, the conclusion derived was that the seat of the dropsy was in the lung. This symptomatical aspect of pathology was changed during Puchelt's later years, by the work of Rokitansky, to an anatomical one. Fevers were usually considered as arising in the digestive system and, therefore, emetics and purgatives were in order.

In spite of practices which today appear strange, Puchelt's clinic was one of the best in Germany. His clinic was large and he had from forty to fifty cases under his care daily. When Pfeufer came in 1843 as second clinician, the high esteem in which Puchelt was held began to totter. Pfeufer's ready diagnostic methods were more pleasing to the students than the hesitating

methods of the older and wiser master. He was less of a writer but a greater practical worker than Puchelt. In spite of the smaller clinic which was in his care he worked up a reputation which made him the choice among the students.

Pfeufer was not only popular as a teacher but he was tactful socially. As an after-dinner speaker he could not be excelled and his ability to judge good wine could scarcely be equalled.

The surgeon, Maximilian Joseph von Chelius, was a handsome person, medium sized, slender, with fine features. During the summer he gave his lectures on surgery at 5.00 A.M. and ophthalmology at 7.00 A.M. In the operating room he was conservative but skilful. His great popularity centered around his textbook on surgery (1822–1857) which lived through eight editions and was translated into eleven languages.

Among the founders of scientific obstetrics, Kussmaul speaks of his teacher, Franz Karl Nägele, as one who has no second in the accurate investigation which placed

obstetrics on a sound anatomical and physiological basis. As evidence of this, he cites his publications on the "Mechanism of Birth" (1822), "The Normal Female Pelvis" (1825) and "The Obliquely Contracted and Pathological Pelvis in Woman" (1839). The term "Nägele pelvis" is still in use. The obstetrical forceps which Nägele invented and used superseded all others at the time, both in lightness and handiness. His textbook of obstetrics, too, was well received and appeared in eleven editions. His lectures were given in an informal manner. He was an interesting lecturer and presented the driest subjects in the most entertaining manner.

Major operations on the female organs and cesarean operations were not practiced. Attempts at such operations were considered as criminal, since they were almost certain to result in the death of the patient. A certain young doctor and student of Nägele received severe condemnation in the public paper for having attempted a cesarean operation which

proved fatal. Nägele was called into court to express his opinion as to the necessity of this procedure. When the young doctor was asked why the operation was attempted he testified that he performed it because of the small pelvic opening, which was so small that he could not insert his finger. Nägele coughed, feigned epistaxis and walked out. He summoned the young doctor and asked him why he made such an excuse, for to medical science it was known that at childbirth the pelvic opening was always large. The young doctor, however, insisted on the correctness of his finding. Nägele, however, did not believe him, but in order to give justice to all he insisted on exhumation. The postmortem proved that the young doctor's findings were correct and the young doctor escaped severe punishment.

During Kussmaul's last four semesters he was Dr. Nägele's assistant, which experience he prized highly. On one occasion Kussmaul accompanied Nägele on a consultation which took them on a two-day trip. After the consultation they were

invited to visit a famous paper mill. All the ladies of the institution were especially interested in seeing the great German obstetrician. Nägele made use of his wonderful command of words to charm the fair ones. One lady called Kussmaul to her side and told him that of all the doctors in the world Nägele was the most charming. On the way back Nägele directed this question at Kussmaul: "Tell me, did I perform this task well? I tried my best to please the ladies, however, only for your sake. I want you to know how to begin your career in order to get ahead. Believe me, without the ability to charm the ladies the doctor cannot succeed."

While Kussmaul practiced obstetrics only five or six years, he did not lose the inspiration received from his much-thought-of teacher. This is evidenced by his paper on the pathology of the uterus (1859).

On November 22, the University of Heidelberg always celebrated the anniversary of its rededication. Connected with this celebration was the presentation of the

Karl Fredrick Gold Medallion to some student who satisfactorily solved a proposed problem. During his last year Kussmaul was asked to prepare a paper on the anatomical, physiological and pathological nature of the color changes in the fundus of the eye. Chelius had proposed this topic and was chiefly concerned in having a critical compilation of the various theories regarding the nature of glaucoma, and especially the reason for the green-blue appearance of the pupil in this disease.

Kussmaul accepted the opportunity gladly. The hope dawned in him that he might fulfill his father's wish and bring home the gold medallion. He began on his work with great enthusiasm. He soon discovered that the solution of the whole problem rested on the questions: Why is the pupil of the normal eye black? Why are the retinal vessels and the entrance of the optic nerve not visible when you look into the pupil? In the previous century Mery had discovered that these structures can be seen when an eye is placed under water. Kuss-

maul made the same observation and concluded that the solution was to be looked for in the field of dioptrics. That the color phenomenon was due to refraction was conceived by him through this study, but no more. He concluded that if this be the case an optical instrument could be made that would permit one to see the actual structures in the fundus of the eye. He worked hard to perfect an ophthalmoscope and he actually made one and described it in his account of this work. The only trouble with it was that it did not work. He asked Dr. Jolly, the professor of physics, for help, but in vain. He lamented to Dr. Helmholtz that he did not succeed in perfecting the ophthalmoscope which he was sure was possible. It took the genius of Helmholtz to fulfill his dream. Wright, in his history of the ophthalmoscope, credits Kussmaul with two important steps. He was the first to raise and correctly formulate the question as to why the inner part of the eye appeared black. In the second place he was the first to attempt a practical application of Mery's observations.

Kussmaul's paper was published in the spring of 1845. He received great praise for the splendid work and was awarded the gold medallion. The following year the faculty, because of a minority opposition headed by Henle, refused to grant the wish of Nägele that this publication should be accepted as a thesis toward the degree of Doctor of Medicine without further expense to Kussmaul. Most students did not take the degree because of the extra expense. The permit to practice was only granted upon successful completion of the state medical examinations. The degree of Doctor of Medicine did not give this privilege in Baden.

IV

FURTHER STUDIES AND TRAVELS

In the spring of 1845, after Kussmaul's graduation, his family moved to Wiesloch, where his father was in practice. Kussmaul's friend, Doctor Bronner, also lived in this village. The two at once decided to begin their preparation for their state examinations. Their activities with the reorganization of a fraternal organization at Heidelberg had kept them from completing their preparations. They left their noisy homes and rented a quiet room in another part of the town, where they worked all summer and winter until the spring of 1846, when they took their first examination at Karlsruhe. The last part they took in October, 1846. The examinations were given in three parts. The first was on internal medicine together with anatomy, physiology and

natural science; the second on surgery and ophthalmology; and the third on obstetrics. A certificate was accordingly given for the successful completion of each part. The first entitled them to the official title of *Arzt* (physician), the second, *Wundarzt* (surgeon) and the third *Hebarzt* (obstetrician). Many candidates took only one or the other of these certificates. Kussmaul took and successfully passed all of them. The examinations lasted about four weeks. Most of them were written, although in some subjects oral questions were also asked. Clinical examinations were conducted from 8.00 to 9.00 A.M. From 9.00 to 12.00 noon and from 2.00 to 8.00 P.M. the examinations were written. The oral examinations, when given, were held after 8.00 P.M.

In botany a short oral examination was always held, during which time it was customary for the examiner to feel the candidate's pulse. The examiner in pharmacology was an old and deaf man. At the oral examination, which was always witnessed by the entire committee, he gave a stick of

cyanide of mercury to one of the candidates to name. The candidate licked at the poison several times in an attempt to diagnose it. Suddenly one of the irritated examiners called out: "Stop your licking, its cyanide of mercury." The candidate thereupon called into the examiner's ear: "It's cyanide of mercury." This answer gave complete satisfaction.

During the summer of 1846 Kussmaul attended the clinic at Heidelberg. Later in the summer he became assistant in Pfeufer's clinic and remained there during the winter of 1846–1847. His experience, during this stay, was broadening in its nature. Contact and actual experience provided a training which textbook and classroom could not give.

Among these experiences were Kussmaul's contacts with miraculous cures. The cook at his boarding house was subject to hysteria. During these attacks she was unable to speak. Medical treatment had brought no relief. Someone had told her of a charm that was sure to cure. It did in her case. Whenever the attacks occurred

she used this charm and her voice was restored at once. Kussmaul and Bronner tried for some time to learn the secret and one day their wish was fulfilled. The cook, who had just been subjected to one of these attacks, came to the room where Kussmaul and Bronner were. She pointed to her larynx. She could not talk. She at once began her demonstration. She took three steps forward and mumbled some words, stopped a moment, took three steps backwards and again whispered some words, and then turned her head and spit three times. She then turned to her audience and in a clear voice uttered these words: "Jesus Christ be praised! Gentlemen I am healed." She then explained that after the first three steps she whispered the three highest names. After the three backward steps she said "This is for you, oh devil," and then spit into his face three times.

A messenger came to Kussmaul's father one day and asked him to come to his master, a farmer who had been ailing for some weeks, had lost his appetite, become

emaciated and was confined to his bed. The doctor gave him a bottle of yew-tree extract with syrup and told him that he would call in a day or so. When after two days he arrived at the farmer's house, he learned that this harmless medicine had done wonders. The farmer greeted him joyously. "Doctor you certainly did wonders, it was a 'horse-of-a-cure,' it cleansed me thoroughly and dispelled my disease. However, the second dose of these ants I was unable to take. There are still some of them in the bottle in the window." The doctor looked at the bottle and to his great surprise found a number of large ants in it. He investigated the matter and learned that the messenger had rested on the way and when he picked up the bottle which he had set on the ground beside him he found a swarm of ants pushing each other into the bottle trying to taste the sweet juice. The messenger, afraid lest he be reprimanded, brought the modified medicine to his master without a word of explanation.

The belief in witchcraft and animal magnetism was quite general. The physical influence of these activities resulted in many miraculous cures. The child of a close friend of Kussmaul was suffering from epileptoid convulsions. The convulsions had lasted half a day and all of his attempts to bring relief were in vain. In desperation he took a dove and pressed its anus against the anus of the child. The convulsions stopped and did not reappear until the death of the child twenty-four hours later. This practice was called the pigeon cure, and was widely used by the common people.

In later years he once more used this cure in a modified manner. A lady of aristocracy was suffering from hysteria. She had tried many treatments but with no effect. When Kussmaul came to treat her, she had been confined to bed with paralysis of her legs for sixteen years. Every afternoon she had an attack. She claimed that during these attacks her heart stopped beating for ten minutes at a time. She suffered severely

and was willing to try anything that money could buy to bring relief. She was greatly impressed by Kussmaul's personality and begged him to come every afternoon during her attacks, because she felt that his magnetism brought her relief. Kussmaul's duties did not grant this time and in his desperation he resorted to the pigeon cure. A pair of turtle doves was secured and when the attack approached a dove was pressed against the thoracic wall overlying the heart. She discovered that the male dove was most effective. This procedure brought great comfort to her and she lived to a ripe old age, but to her last day she received relief from the pair of turtle doves.

The therapeutic measures which were almost exclusively used during Kussmaul's clinical years were purgation, phlebotomy and emesis. The old saying: "Qui bene curat, bene curat" was certainly put into practice. Purgation still is holding its own, but the almost complete cessation of the practice of phlebotomy seems hardly warranted in the face of the wonderful results

which were thus secured in the earlier days. Every clinic was well supplied with cupping instruments and they were used daily. In certain communities bloodletting was a routine hygienic measure employed every spring. The blood was thought to become stagnant during the winter and it was necessary to remove this in order that the new which was produced in springtime might have room.

A lady patient of Kussmaul told him that in her earlier years she had a case of encephalitis complicated with peritonitis. Her doctor resorted to seven bloodlettings in six weeks and in addition applied sixty leeches. She recovered and lived to be eighty-three years old.

Kussmaul was not plethoric, but in case of a severe infection in the hand which was accompanied by fever and severe pains in the arm, his doctor removed twelve ounces of blood. He immediately felt much better and recovered completely in four days. Kussmaul was a strong advocate of phlebotomy and severely criticized the school at

Vienna for trying to do away with the practice. He had two cases of nephritis in an advanced stage which were accompanied by dyspnea. In the one he used the methods advocated by the Vienna school and the patient died. In the other he resorted to phlebotomy and the patient recovered.

Kussmaul was also a strong advocate of emesis. In his own case he resorted to this method repeatedly and always with the desired result. These personal experiences led him to the extensive use of the stomach pump in stomach disorders.

His writings and extensive use of the stomach pump have led some to believe that he was its original inventor. This, however, is not the case, as is gathered from the following extract from Frank Smithies' paper[1]:

In "*The Journal,*" February 21, p. 606, it appears that our German confreres are exercised over who first suggested and used the stomach tube and when a celebration in honor of the man and the event should be staged.

[1] Smithies, F. *J. A. M. A.*, Chicago, 1925, LXXXIV.

As so frequently happens in Europe, particularly in Germany, important contributions to scientific and clinical medicine pass unrecognized, should such occur extra muros. To the average German physician, credit for the stomach tube and its employment goes to Kussmaul. Since a celebration in honor of that distinguished scientist and his tube is impending, it would seem proper that the facts relative to the introduction of tubes into the stomach be reviewed.

To Dr. Julius Friedenwald of Baltimore we are indebted for a history of this gastro-enterologic milestone.[2] Friedenwald called attention to an article by Philip S. Physick, M.D., Professor of Surgery in the University of Pennsylvania, appearing in the *Eclectic Repository* of October, 1812, under the title, "Account of a New Mode of Extracting Poisonous Substances from the Stomach." Using a large catheter for the purpose, Dr. Physick washed out the stomachs of three months old twins who, accidentally, had been given an overdose of laudanum. One recovered; the other died. In his paper, the writer asserted that he had employed a tube

[2] *Proc. Am. Gastro-Enterol. A.*, 1917; Introduction, Tice's "Practice of Medicine," VII, Sect. X, p. 15.

for washing out the stomach during the preceding twelve years, and had for "many years" recommended its employment in his lectures. In 1809, according to Friedenwald, Dr. Physick's nephew, a Dr. Dorsey, placed on record a case similar to Dr. Physick's twins. In 1822, an English surgeon, Dr. Jukes, published an article in the London "*Medical Repository*" entitled "Description of an Apparatus for Removing Poison from the Stomach, invented by Mr. Jukes, Surgeon," but presumably made no mention of the paper of ten years earlier written by Dr. Physick. Thus, the view was generally accepted that the stomach tube was of English origin. It was not until 1867 that Kussmaul employed gastric lavage on the now famous (in Europe) "Marie Wiener," who was affected with enormous dilatation of the stomach consequent on pyloric stenosis due to the cicatrix of a large peptic ulcer. Kussmaul's paper "Ueber die Behandlung der Magenerweiterung durch eine neue Methode mittelst der Magenpumpe," did not appear until years later.[3]

Kussmaul, seemingly, gave no credit in his writings or his lectures to Drs. Dorsey, Physick

[3] *Deutsches Arch. f. klin. Med.*, Leipz., 1869.

or Jukes. Apparently, too, he had little conception of the diagnostic possibilities of employing the stomach tube in securing gastric contents for analysis: he seemed content to emphasize tube lavage only as a therapeutic agent. Further, it remained for Jurgensen (1870) to point out that the "pump" of Kussmaul was objectionable from the standpoints of cleanliness and practicability. Jurgensen employed the soft rubber tube and introduced the principle of siphonage in securing specimens for observation and as a means of lavage.

It is of interest that on page 380 of the same volume of the *Eclectic Repository* referred to by Smithies, Dr. Physick gave credit for the first attempts to wash out the stomach to Dr. Alexander Munro, Jr., who published an account of it in his inaugural thesis in 1797.

During the winter of 1846–1847, while assistant in the clinic at Heidelberg, he himself became ill with acute articular rheumatism complicated by pericarditis. His treatment consisted of a cold pack on his heart and a daily sponging of joints

with a warm 0.5 per cent solution of potassium hydroxide. The latter treatment always brought relief. He was confined to his bed for two months, during which time he took little nourishment. Bed sores also developed, which added to his discomfort. During the latter part of February his appetite returned and he soon recovered. His heart remained irritable for a long time, especially to coffee and tea, but not to wine.

Travels and Studies in Vienna and Prague

In the early spring of 1847 Kussmaul's strength was rapidly restored and he again met his friends and duties with enthusiasm. A number of his classmates, among whom was his closest friend, Dr. Edward Bronner, had just returned from Paris, where they had spent the winter and had equipped themselves with the latest medical instruments and methods. The newest among these was the use of ether as an anesthetic. Eli de Beaumont, on November 13, 1846, presented to the "Academie der Wissenschaft" a letter from his friend Dr. Charles

Jackson. From this letter it appears that on September 1, 1846, a dentist Morton, upon the suggestion of Jackson, administered ether fumes and thus for the first time performed a painless dental operation. On October 16, Dr. Warren likewise painlessly opened a cervical abscess. Since Jenner's discovery of vaccination nothing had so stirred the medical profession and the public as did the use of ether. The doctors of Paris devised appliances for its administration. It was through Kussmaul's classmates that these appliances and the methods for using ether as an anesthetic were introduced into Germany. It was in Kussmaul's room that the young doctors experimented with the administration of ether on each other. These experiments afforded amusement in several instances when the subjects divulged secrets while under its early influence.

The many new views obtained in Paris caused Dr. Bronner to induce Kussmaul to visit other important medical centers before entering into a practice of their own.

Because of financial aid from a friend Kussmaul was able to accept the invitation.

There were three medical centers which they desired to visit: Vienna, where Hebra, Rokitansky and Skoda were making a reputation and where Semmelweis was about to make his epoch-making discoveries relative to asepsis and puerperal fever; Prague, where Oppolzer was in charge of a large clinic and a hospital of 150 beds; and Berlin, where Virchow was gaining a reputation by his micropathological studies, his opposition to Rokitansky's and Skoda's skeptic and annihilistic tendencies in the purely diagnostic values which they placed on pathology, and by his attempt to derive therapeutic and curative values from the pathological findings. Their visits to Vienna and Prague were completed, but their plan to visit Berlin was not realized, due to the outbreak of the French Revolution.

On a beautiful May day Bronner and Kussmaul left Heidelberg, arriving in Munich three days later. Modes of travel were slow in those days and as a result they had

plenty of time to enjoy the trip. They spent some time in seeing the sights at Munich. From Munich they continued their way over the Alps, a trip which they enjoyed very much. After about a month of travel they arrived at Vienna. The first day was spent in having their trunks delivered to their rooms. At the duty office the officers took careful inventory of their contents. At the bottom of the trunk the officers found the anatomical texts of Hyrtl and Rokitansky. These they censored as printed matter and insisted, in spite of protests, that they be taken to the censor. With the books under their arms one of the officers led them to the nearest official censor. Of course no trouble was encountered with the censor and as soon as their trunks were again packed they were delivered to their destination.

From Kussmaul's own description one concludes that he thought highly of the medical building, equipment and faculty of the Vienna Medical Institute. The capacity of the General Hospital, the obstetrical division, the children's hospital, and the

hospital for the insane, was over 2000. Cases of almost every description were there. Autopsies were performed on all who died there and also on medico-legal cases which occurred in the city. In all, about 1600 autopsies were performed yearly. The number of childbirths numbered about 3000 annually.

The following characterization of the outstanding faculty members is sketched from Kussmaul's own account. Kussmaul and Bronner arrived at Vienna during the vacation period and the only course given was one on skin diseases by Dr. Hebra. Among the large number of courses which they visited during their stay there, Hebra's was by far the most instructive. From 7.00 to 9.00 A.M. he lectured systematically and interestingly on all forms of skin diseases, and the rest of the morning was spent in the clinic diagnosing the numerous cases of every type.

In the children's hospital he saw the most pitiful cases of septic diseases in children of various ages. In later practice Kussmaul encountered very few of these. He blamed

these severe conditions to the imperfect aseptic methods employed. He writes: "As long as the methods for combating sepsis were only imperfectly known, these institutions were hardly better than dens of murderers."

One of the outstanding members of the new Vienna school was Rokitansky. As pathologist a great part of his time was spent in the small, poorly equipped morgue. The morgue, besides the storage place, consisted of two rooms, the small one for the medico-legal cases which occurred in the city, and the large room for the bodies of the patients that died at the hospitals. Rokitansky performed all the medico-legal autopsies and as many others as he was able. His assistants did the rest. Rokitansky dictated the findings in a brief but very systematic manner. Kussmaul reports that in the half year spent at Vienna most of his time was spent at the autopsies of Rokitansky, and as evidence possessed 170 detailed protocols and almost as many short autopsy notes. His records show that he visited

about 300 autopsies during his stay there. Kussmaul took great interest in the variations in the position of abdominal viscera, and expresses the view that a knowledge of such variations is essential for accurate diagnosis of the various abdominal diseases.

A most interesting portrayal of Rokitansky is given by Kussmaul in the following paragraph:

> The facial features of Rokitansky bore the stamp of great kindness of heart and of dependableness. Everyone respected him. He was extraordinarily silent. In the morgue he opened his mouth only to dictate the protocol. After I had been a constant visitor at the morgue for four months, it happened one beautiful autumn morning that the scalpel rested for a short period. I took advantage of the short recess by stepping to the door in order to enjoy the fresh air. Soon after Rokitansky came and stood near me in the sunlight, which he enjoyed noticeably. Suddenly he turned toward me, greeted me pleasantly, and said: "This is nice weather." I was dumfounded. Had the daughter of Jairus suddenly arisen from the dead and come to me from the morgue with a loud greeting I would

not have been more surprised. I composed myself, however, and answered: "Yes, this certainly is a nice day." The conversation was finished. It was the first and only conversation in which I heard him take part.

Kussmaul states further that while Rokitansky commonly appeared very dry, his eyes would suddenly shine and his whole bearing show great enthusiasm whenever he found an unusual pathological condition. Kussmaul did not take his lecture course but was informed by other students that while Rokitansky was a great anatomist he was but a very ordinary teacher.

As Rokitansky was the chief character in the anatomical sphere at Vienna, so his scholar Skoda became the outstanding individual in the clinical sphere. His specialty was diseases of the chest. He perfected and developed the methods of auscultation and percussion and their interpretation to such an extent that his diagnosis almost without exception was correct. This accuracy was obtained by careful correlation of the findings of auscultation and percussion

with autopsy findings. Students from all parts of Germany flocked to Vienna to study diagnostic methods under Skoda. Skoda was not satisfied with revolutionizing diagnostic methods, but centered his severest criticism on current therapeutic measures. He considered all medical remedies as then used as mere guesses, and taught his students so. The great evil in this teaching was that he had nothing to substitute. His students, therefore, left Vienna and entered practice with the conception that their work was to make accurate diagnoses and then substantiate them by autopsy findings. To do nothing is the best policy in internal medicine was an axiom which most of Skoda's students followed.

Not only Skoda, but the whole new school at Vienna took this skeptical attitude. Diphtheria was never diagnosed in the large children's hospital simply because it was considered as a French invention. Even Hebra severely criticized such a disease as argyria. In one of his lectures he made this statement:

Sirs, in argyria I do not believe. In the stomach silver nitrate is changed to silver chloride and is thus removed from the body through the intestines. We have given this drug to epileptics for years and have never had a case of coloration of the skin. In Paris and Berlin they claim to have numerous cases; it may be that the sun shines brighter in Berlin. Argyria? I wish to place a question mark after it.

Three months after Kussmaul left Vienna he saw a case of it. Most students left Vienna as skeptics, and only that which they saw and heard in Vienna did they believe. Both teachers and students forgot the true mission of medicine, namely to cure, and centered all of their efforts on correct diagnosis and substantiation of this diagnosis at autopsy. The desire to perform an autopsy after a diagnosis was looked forward to more than the recuperation of the patient.

When Kussmaul left Vienna he felt that he had learned much regarding physical diagnosis and more from autopsies, but he made it one of his chief concerns to combat skepticism and try to effect cures.

Before leaving Vienna we must acquaint ourselves with Semmelweis, the one man whose thought and work turned away from the skepticism of the young school at Vienna to the problem of effecting a cure. His influence on Kussmaul was profound. Kussmaul describes Semmelweis in the following words:

He was a man of more than medium size. He was broad and well built. His face was round, his cheek bones were projecting, his forehead was high and the hairs on his head were few in number. His hands were unusually busy and deft. He had a lively temperament, great power and joy for work, and a warm and sincere heart.

Semmelweis was greatly attracted by Kussmaul and gave him all the help possible. After he had attended Semmelweis's course in surgery, Kussmaul was permitted to practice in the obstetrical hospital for six weeks, a privilege seldom granted. Semmelweis was always ready to help, even when tired after a night's watch at the sick bed or busy with many duties.

On March 13, 1847, shortly before Kussmaul came to Vienna, Semmelweis had made his epoch-making discovery concerning the cause of the widespread existence of puerperal fever. Dr. Kolletschka had contracted a blood poisoning at an autopsy and died. At the autopsy Semmelweis noted that the autopsy findings were identical with those of patients who died from puerperal fever. He concluded that Dr. Kolletschka contracted the poison from the decomposing body through a cut on his finger, but that the poison was carried by doctors from the autopsy room to the women in confinement. He had also noted that the percentage of puerperal fever cases was much greater in the obstetrical division which was attended by doctors who were connected with autopsies. He, therefore, required all those who conducted examinations at childbirth to wash their hands in chloride of lime before the examination. The percentage of cases dropped almost at once.

In spite of these facts he met much opposition, even from Dr. Klein, who had

charge of the obstetrical hospital. The opposition grew throughout the life of Semmelweis, but in spite of this he worked harder to perfect methods to prevent this dreaded disease. It was not until after he died that the value of his discovery was recognized. Among all of the men Kussmaul met at Vienna there was no one he regarded so highly as Semmelweis.

On December 27, 1847, Kussmaul and his friend Bronner left Vienna for Prague, where they arrived the following afternoon. They stopped at the Blue Star Hotel. The following morning, before they could leave to find a more suitable rooming place, five servants at the hotel reported for a tip or *drink geld* as they called it. This practice Kussmaul was introduced to in Vienna. In Germany this custom was not tolerated.

To the great surprise of Kussmaul the Medical School at Prague was visited by a much larger number of graduate doctors than that at Vienna. The reason for this was that the courses were more practical and

interesting. Matters of practical value to the physician were emphasized and the spirit of skepticism was, therefore, not so noticeable as in Vienna.

The outstanding teacher was Johannes Oppolzer. His great interest in his students and his desire to give them every opportunity for study brought him high esteem.

The neuropsychiatric institute at Prague, with excellent courses on the subject, was another reason why Prague was so popular as a medical center.

After three months' stay at Prague, Kussmaul and Bronner decided to go to Berlin to become acquainted with Professor Virchow, who was just gaining great reputation as a pathologist, first because of his critical attacks on the skeptical teachings of the school at Vienna and secondly because of his use of the microscope in pathological description and diagnosis.

Two days before they had planned to leave for Berlin they received word of the French Revolution with accompanying border trouble. Kussmaul at once decided

to leave for his home and join the army. He arrived at Heidelberg the latter part of March, 1848, and within a month applied for the position of army surgeon. On August 13, 1848, his battalion began its march to the north coast, where the Danes were causing trouble. Instead of leaving early in the morning, when it was yet cool, a farewell party was instigated. As a result, many of the soldiers were intoxicated or nearly intoxicated. When they finally started, the sun beat uncomfortably on the already toxic soldiers so that by noon dozens of them lay along the road. Kussmaul was busy all day resuscitating them, and luckily no casualty resulted. When the battalion reached Holstein it received orders to return. On the way back an epidemic of cholera broke out among the soldiers. Because of the excessive loss of fluid from the body in this disease the blood was thought to be very thick and, therefore, Kussmaul had been taught to resort to phlebotomy. His first two patients thus treated died soon afterwards without

experiencing relief. Thereafter Kussmaul never drew blood from cholera patients. Other cholera patients died, but many recovered after administration of opiates.

In October, Kussmaul was promoted to chief physician. On April 14, 1849, he was ordered to take charge of a battalion which was in active service on the battle front in Schleswig. When he arrived there he found only two soldiers who were still in a serious condition as a result of wounds received in a previous battle. During the remainder of his stay there the battle front guarded by his battalion was quiet. The only surgical case he had was the amputation of an arm of a soldier who accidentally discharged his gun while on a forbidden hunt.

In July, the Danes concluded several successful battles, which resulted in the peace treaty of July 12, which gave Schleswig to Denmark. One year later Holstein was also given over.

During the early summer, before the peace treaty was concluded, mutiny arose in the army of Baden. At first the insurrec-

tion seemed to be successful, but by the middle of the summer the rebels were defeated and large numbers taken prisoners.

When Kussmaul returned from Schleswig and Holstein, he was placed in charge of the sick among the prisoners. After repeated requests he was honorably dismissed from the army on December 27, 1849.

V

KUSSMAUL IN PRIVATE PRACTICE

During his military service Kussmaul was located at Kandern for several months. He made many friends there. When, therefore, one of the local doctors left Kandern, Kussmaul was asked to begin his practice there, which he did early in March, 1850. He rapidly established a splendid practice. This rapid prosperity was chiefly responsible for his decision to establish a home of his own. The wedding was set for August but the sudden death of his father necessitated its postponement until the latter part of September, 1850. Mrs. Kussmaul, a bright, witty, attractive, but devoted young woman, proved to be a great source of comfort and inspiration to Dr. Kussmaul during his severe illness several years later and during the consequent trying period of

his life when he was forced to lay down his heavy country practice and prepare himself for an academic career.

Kussmaul's practice in the country surrounding Kandern was among two classes of people. The one, a mountain folk, was sturdy, uncultured and superstitious. They agreed with their local druggist that in the curing of a disease the axiom of Hahnemann was trustworthy: "Similia similibus." Thus for a case of volvulus an extract of horse apple (*stercus equinum*) was prescribed, not in homeopathic but in allopathic doses. Tumblerfuls were taken at a time. In spite of the control the druggist had over these folk, Dr. Kussmaul had many calls from them. It was they who invariably would ring his door bell at 4 A.M. in order to have the doctor perform a phlebotomy or prescribe a strong medicine. (A mild drug was not acceptable). A strong brandy or a bitter medicine was most welcome. Autopsies were not permitted by these people. Kussmaul performed only one autopsy amongst these mountain people

and that was on the wife of a young, somewhat enlightened carpenter. This permission was obtained after informing the carpenter that the doctor would ask no fee for his services if the autopsy were permitted. The autopsy was performed, but under severe protest of the neighbors.

The other class of people was the lowlanders. They were enlightened progressive farmers whose livelihood came from raising wheat and making wine. Their attitude toward autopsies was very different. They looked forward toward an autopsy with a keen sense of curiosity. On one occasion an elder of a church came to Kussmaul and requested him to consent to autopsy his daughter as soon as she died. He stated that she suffered with a chronic tuberculous peritonitis, was much emaciated, that her abdomen was greatly swollen and that her death was to be expected at any moment. He requested the autopsy all the more because all the members of the church were anxious to know what an autopsy would reveal. Dr. Kussmaul informed the elder that he

did not consent to an autopsy as long as there was life. He found the girl under miserable care. He ordered cleanliness, absolute rest and proper food. To the surprise of even Dr. Kussmaul the girl recovered.

Among these two classes of people Kussmaul experienced an unusually heavy but entertaining practice. The lowlanders kept him late at night and the mountaineers woke him long before the sun was up in the morning.

In spite of this heavy work Kussmaul found time to read and write. He kept up with current medical literature and wrote accounts of unusual cases in his own practice. The first of these, entitled "Zur pathologischen Anatomie des Rheumatismus acutus articulorum," appeared in the *Archiv für physiologische Heilkunde.*[4] He reported two cases. The one healed spontaneously, the other he autopsied. Two years later Chassaignac characterized this type of disease as osteomyelitis. Both of Kussmaul's cases were complicated by

[4] Stuttg., 1852, XI.

rheumatic inflammation, namely pericarditis and polyarthritis.

A second paper, entitled "Belege zur Kontagiosität der Ruhr, nebst einigen Bemerkungen über ihre Therapie," appeared in the *Mittheilungen des badischen ärztlichen Vereins.*[5] This was an epoch-making masterpiece on the dread epidemics of dysentery which were so common at that time. He showed himself to be a real teacher of therapy. In the following paragraph he gives it as his opinion, based on his own experience in handling cases in the army and in the vicinity of Kandern, that the methods of treatment used were wrong:

Having had my attention called, in several severe and death-threatening cases, to the fact that by the use of energetic drugs, especially calomel and opium, the condition was aggravated, and that by the discontinuance of these drugs and the use of indifferent mixtures marked improvement and healing resulted, I have, in more than thirty carefully observed cases,

[5] Karlsruhe, 1853, No. 2.

employed the therapy of waiting, and my patients appeared to me to be doing better.

"Stomatitis septica" was the title of another paper which appeared in the *Mittheilungen des badischen ärztlichen Vereins.*[6] This was a novum, as autopsy reports were known of only in the cities where Rokitansky and Virchow were active.

Again, from his own practice he wrote a paper entitled: "Erfahrungen über den Abdominaltyphus in der Umgebung von Kandern in den Jahren 1850–1853," which appeared in the same journal.[7] He presents etiology, symptoms, prognosis, pathological anatomy and therapy. In the treatment of these cases Kussmaul followed an anti-symptomatical course. In high fevers he gave vegetable acids or dilute hydrochloric acid, a therapy which is still considered sound at the present time; in obstinate cases of constipation, mild laxatives such as tamarind and a little potassium sulphate; in severe

[6] 1853, No. 8.
[7] 1853, VII, No. 13.

cases of diarrhea he gave silver nitrate, which actually brought the desired results. When uncertain, Kussmaul emphasized plenty of fresh air and cold water.

Another paper, entitled "Gallenstein-kolik und Phlebitis hepatica mit Ausgang in Ascites," also appeared in this journal.[8] One of his cases, a woman, used aurum muriatico natronatum and recovered from a severe case of dropsy. Kussmaul does not believe that the drug caused the cure. He says literature is full of remedies where recovery occurred while they were employed. He knew of a case where cancer of the stomach healed while the patient was on a milk diet. He, however, did not believe that the diet caused the cure.

At the time when some of these papers appeared and when others were still in press, Kussmaul was confined to bed with a severe case of what he called "meningitis lumbalis." Kussmaul, in his autobiography, gives a picturesque description of the unusually busy winter and the consequent

[8] 1856, No. 19.

weakening of his body which was the cause of the contraction of this dreaded disease, which forced him to lay down his duties as a country doctor. The winter of 1853 was mild until February, when severe weather set in. Sickness was very prevalent throughout the winter, but increased tremendously with the onset of ice and snow. Kussmaul was unable to attend to all of the cases. Not a night passed in which he was not called from his bed. He could no longer eat his meals at regular hours and did not eat enough. Already in an overtaxed condition, he accepted a consultation call to a neighboring town. The trip was made on horseback. He started before sunrise and returned late at night. On the way home he had a feeling in the soles of his feet as though he was walking on rough felt. It was a skin paralysis, but Kussmaul did not realize its serious indication. He had hardly retired when he was called on a case which kept him the entire night. When he returned home the sun had arisen and new work was awaiting him. Night came again and he hoped to gain

the desired rest, but he had hardly retired when he again was called to a case which kept him all night. The new day had its work in store. Immediately after breakfast he made a trip by sled to a neighboring town. Snow was falling fast and by the time he reached his destination he was wet to the skin. On the way back the sled tipped and he fell in the deep snow. He could not retire at once on returning home and after he did retire did not get warm until midnight. He had hardly fallen asleep when he felt severe pains under his left scapula. He feared pleurisy. A fever complicated his condition and he spent a sleepless night. Toward morning when he was about to go to sleep a messenger came to remind him that he had promised to perform an operation for hairlip. There was no other way; he kept his promise and completed his operation successfully. The little girl on whom the operation was performed developed a beautiful face. When Kussmaul returned home he had to write prescriptions for several farmers before he could retire.

His condition had reached a serious state and could be readily diagnosed. His legs were weak and cramps occurred frequently. He could hardly stand. His feet were senseless and his bladder paralyzed. Pain was intense. His diagnosis was spinal meningitis but the symptoms and prognosis suggest poliomyelitis. He faced a terrible prospect. Either the infection would ascend, paralyzing his arms and finally his respiratory mechanism, or else it would halt in the lower parts, causing a permanent paralysis of the lower extremities which would make him unfit for his occupation. During the first days he took strong wine and washed his legs with warm water, but his condition did not improve. At the end of the first week worry and anxiety led him to employ a method which he did not dare to use with his patients. He took one grain doses of tartar emetic at two day intervals. Unusual vomiting ensued. His conception of meningitis was erroneous. He thought a fluid had formed in the meninges similar to that found in the joints during acute articular rheumatism. He hoped that by excessive

vomiting this fluid would be drawn from the spinal canal.

This method brought results: after the third dose the paralysis of the bladder subsided. The paralysis of his legs, however, subsided very slowly. It was the middle of April before he could leave his bed and it was a number of years before he could use his legs normally.

As soon as hope for complete recovery was in sight Kussmaul decided to give up his country practice and prepare for the academic life which he had always hoped to enter. He had saved enough money, so he thought, to study for several years, get his degree, and then enter teaching. Seldom does one find a practicing physician give up his practice to enter academic life. Kussmaul did not realize the cost of this change and after two years was almost forced to reenter private practice. Had it not been for the encouragement of his wife during this trying financial period of his life, Kussmaul would never have been able to live the productive academic life which he did.

VI

ACADEMIC LIFE

Virchow had left Berlin. In the autumn of 1849 he was forced to leave because of his democratic views. Virchow, therefore, went to Wurzburg, where he became very popular. Kussmaul was attracted by Virchow and chose Wurzburg for his further study. Kussmaul was now thirty-two years old. He stayed there two semesters and in the summer of 1854 received his degree of Doctor of Medicine. From Wurzburg he went to the psychiatric institute at Illenau, where he gathered many new ideas which permeated his work during the next two or three years. Early in the winter he returned to Heidelberg where in the following year he was tendered the position of *privat-docent*.

When Kussmaul took his doctor's degree at Wurzburg he was excused from writing

an inaugural dissertation on condition that he would do so after he got to Heidelberg. His paper on the "Influence of the Interruption of the Blood Stream through the Neck Arteries on the Movement of the Iris and Other Parts of the Head," met this requirement. When Kussmaul wanted to become situated at Heidelberg he learned that before he could lecture he had to pass a doctor's examination at Heidelberg. His doctor's degree from Wurzburg was not accepted as a fullfillment of this requirement. He, however, was not required to write a *habilitation* dissertation because he had some years before written the prize paper on the color of the eye. He had to undergo the ordeal of a promotion and *habilitation* disputation. The thesis which he chose to defend was entitled: "Marriage among Relatives is Improper on Conventional and not on Physiological Grounds." For some unknown reason, maybe because of the extreme novelty of the subject, the faculty permitted it to pass and published it on the bulletin board. Within a few days the topic

was the talk of the whole city. The clergy registered severe protests, but the faculty had passed on it and their decision was not changed. At the disputation as many were present as could be packed into the hall. Kussmaul was in earnest and had carefully worded his thoughts so as not to arouse undue criticism from an already enraged crowd. But to make things worse some of Kussmaul's colleagues asked frivolous questions which were greeted by outbursts of laughter from the audience. Kussmaul answered all of these in a purely scientific manner. After the debate had ended and the committee had deliberated a long time, Kussmaul was called in and informed that he was admitted to the rank and file of the faculty, but that he and, more so, his opponents would be reported to the senate for the frivolous manner in which the discussion was conducted. The senate dropped the matter with a reprimand.

When Kussmaul went to Heidelberg he went with the thought of lecturing on pathology. He, therefore, at once conferred

with Dr. Hasse, the pathologist, but was informed that there was no opening. Dr. Arnold offered him a place in anatomy and physiology, but Kussmaul turned down this offer. His old teacher, Chelius, advised him to lecture on materia medica, since this important department had been neglected at Heidelberg. Kussmaul saw the opportunity and even though this field was not his choice, he decided to take the advice of Dr. Chelius. The government of Baden at the time also laid great weight on medico-legal instruction, and since Heidelberg had no lecturers on this subject, Kussmaul decided to place two irons in the fire at once. He, therefore, undertook to lecture on materia medica, toxicology, legal medicine and psychiatry. At this time Kussmaul was also successful in obtaining the position of assistant physician to the chief physician of the city of Heidelberg. This position offered great opportunity to obtain practical experience in legal medicine.

When Kussmaul was ready to announce his lectures he was too late to have them

printed in the schedule of courses. He, therefore, had to announce them on the bulletin board. To his great surprise, his lectures were attended to full capacity right from the beginning. It seemed that the student body found more interest in Kussmaul's *habilitation* disputation than did his examining committee.

Kussmaul was not a ready lecturer. At first he wrote all of his lectures. Later he made only outline notes, but he always recited his lectures orally before he delivered them. During his forty-two years of teaching, every lecture received individual preparation and only in his clinical teaching was he forced to resort to the extemporaneous method.

Forced by financial circumstances either to be soon recognized as a productive investigator and worthy of a position in the faculty of Heidelberg or to return to private practice, Kussmaul entered with all the strength he could gather into the solution of the problems of the relationship of blood supply to the movement of the

iris; the relation of the sympathetics to temperature changes in the ear; the cause and seat of epileptic convulsions and the nature of the rigor mortis.

Four papers appeared on these subjects during the years 1855 to 1857. The first, "Untersuchungen über den Einfluss, welchen die Blutströmung auf die Bewegungen der Iris und anderer Theile des Kopfes ausübt,"[9] was read March 10, 1855. By an ingenious operation he exposed the vessels to the head of a rabbit and by clamping one or the other of all the vessels he studied the effect. An initial constriction of the iris, nasal openings, mouth and ear muscles resulted when the arterial blood was shut off but was followed by a dilatation. When blood was again allowed to flow, an initial dilatation followed, but a constriction resulted.

The second paper, "Ueber den Einfluss der Blutströmung in den grossen Gefässen des Halses auf die Warme des Ohrs beim Kaninchen und ihr Verhältniss zu den Wärmeveränderungen, welche durch Lah-

[9] Wurzburg, 1855.

mung und Reizung des Sympathikus bedingt werden," was published in von H. Moleschott's *Untersuchungen zur Naturlehre des Menschen und Thiere.*[10]

The most important of his researches of this period are presented in an article entitled: "Untersuchungen über Ursprung und Wesen der fallsuchtartigen Zuckungen bei der Verblutung, sowie der Fallsucht überhaupt," and published in the third volume of Moleschott's publication. This work was done with the help of Tenner and Donders. They showed first that this condition was not so much the change of the volume of the blood stream as the change produced in the nervous system due to the lack of food, resulting either from lack of blood or from a congestion with impure blood. They succeeded in performing an operation to expose all the vessels to the brain and to clamp any or all of them. Thus they were able to produce epileptoid convulsions at will and as often as desired. In the second place they attempted to locate the seat of

[10] Frankfurt, 1857, vol. 1, 90.

such convulsions. They removed the cortex and thalamus and then the mid-brain. They found that all convulsions did not stop until the posterior parts of the corpora quadrigemina were removed and they concluded that this was the place where the seat of convulsions was located.

This work of Kussmaul is thought to have been the reason for his advance and recognition at Heidelberg. Another paper which added to this recognition was: "Ueber die Totenstarre und die ihr nahe verwandten Zustande der Muskelstarre, mit besonderer Rücksicht auf die Staatsarztneikunde."[11] During the summer of 1856 Kussmaul lectured twice a week on the subject of Death. He showed that rigor mortis was the result of chemical change within the muscle and not necessarily due to the death of the nerve, as was commonly believed. He also showed that the approximate time of death could be determined by the state of rigor mortis. It was as a result of this work that Kussmaul was

[11] *Prag. Vierteljahrsschrift*, 1856, XIII, 2.

promoted, in November, 1857, to an assistant professorship. In connection with this promotion Kussmaul delivered an address before the Naturhistorischen-medicinischen Verein zu Heidelberg on the deadening effect of chloroform on the muscles when injected into the leg arteries. He showed that chloroform produces a contraction of the muscles and a stiffening of the legs, similar to that of rigor mortis. In connection with his course in toxicology he noted the type of rigor mortis which resulted from lethal doses of various drugs in rabbits. He observed that rigor mortis in animals killed with the extract of poisoned mushrooms (*agaricus muscarinus L.*) set in two minutes after death and disappeared completely three and a half hours afterward.

On January 25, 1858, at the session of the Naturhistorischen-medicinischen Verein, Kussmaul demonstrated an ovarian duct pregnancy. The specimen had been obtained from a thirty-year-old woman who had died as a result of a hemorrhage caused by the rupture of the placenta. The

placenta was located in the left oviduct near its entrance into the uterus. The left ovary appeared passive while the right ovary contained two corpora lutea. He concluded that the ova entered the right oviduct, crossed the uterus and located in the left oviduct. He delivered another address on May 31, 1858, entitled "Ueber die einhörnige Gebärmutter ohne und mit verkümmertem Nebenhorne."

A paper entitled "Nachempfängniss" was given on January 17, 1859. During the same year he published a book, entitled "Von dem Mangel, der Verkümmerung und Verdopplung der Gebärmutter, von der Nachempfängniss und der Ueberwanderung des Eies." This book has been a valuable text for the obstetrician.

At the meeting of natural scientists at Bonn in 1857, Kussmaul's work attracted great attention. It was there that Gerlach became interested in him, which interest resulted in Kussmaul's call to the clinic at Erlangen, in 1859. At the occasion of his entrance into the faculty of Erlangen,

Kussmaul read a paper entitled "Untersuchungen über das Seelenleben des neugeborenen Menschen." This was published in book form in 1859 and was followed by two later editions, one in 1885 and the last in 1896.

At Erlangen Kussmaul had occasion to study numerous cases of mercurial poisoning which occurred at the mirror factory. Mercury poisoning and syphilis were often confused, and some believed that syphilis was the same as mercury poisoning. Kussmaul, in his "Untersuchungen über den constitutionellen Mercurialismus und sein Verhältniss zur constitutionellen Syphilis,"[12] shows that mercury poisoning and syphilis are two entirely different diseases.

In 1863, under the heading of "Beitrage zur Anatomie und Pathologie des Harnapparats," Kussmaul presented eight short articles.[13] They were: (1) Regarding the diagnosis of tuberculosis of the urinary passages; (2) "Markschwamm" of the left

[12] Wurzburg, 1861.

[13] *Wurzburger med. Ztschr.*, vol. IV.

kidney; (3) Hydronephrosis as a result of a crossing of the right ureter with an accessary renal artery; (4) Pyonephrosis with an unusually large kidney; (5) A case of "Morbus Brightii"; (6) A study of "Paraplegia urinaria"; (7) Microscopical findings in the urine in a case of jaundice; (8) A typical case of Addisonian disease.

Later[14] Kussmaul published an article entitled "Rheumatismus articularis acutus mit Tuberculosis miliaris—Wanderung eines verschluckten Dorns in das Herz und ein freies Konkrement im Herzbeutel." In this he teaches that the symptom complex then known as Rheumatismus cerebralis can be produced by a tubercular basilar meningitis. The same patient on whom these observations were made accidentally swallowed a thorn about a year and a half before his death. He complained of pain in the precordial region for a long time. At autopsy the thorn was found in the heart. On its way from the esophagus to the heart an infection must have been caused in the peri-

[14] *Ibid.*, 1864, vol. v, 61.

cardial chamber, which resulted in a free pericardial stone. This was the first account of such a structure. The thorn itself had found its way into the interventricular septum and progressed toward the right into the heart cavity, where the greater part of it was exposed to the blood stream. A white fibrin mass surrounded it.

In 1863, Kussmaul returned to his home state, Baden, where he accepted the chair of internal medicine at the University of Freiburg. His inaugural address, on "Die Entwicklungsphasen der exacten Medicin," was timely since it emphasized the necessity of systematizing and stabilizing the methods in internal medicine, which had been almost entirely ignored by the skeptical teachings of Skoda.

Kussmaul's first publication in Freiburg, "Zur Diagnose der Embolie der Arteriae mesentericae,"[15] appeared in 1864. A diagnosis of this type was new in his time. In the article he states how he could tell whether

[15] *Wurz. med. Ztschr.*, vol. v, 210.

the embolus was in the superior or inferior mesenteric artery. In numbers 50 and 51 of the *Deutsche Klinik* he reports two cases of spontaneous gradual closing of the large arteries of the neck.

His paper, "Uber den Schnupfen der Säuglinge," was published in 1856.[16] He shows that catarrh in children of one year or under is much more serious than in adults because of the position of the tongue. The sucking position of the tongue in children makes breathing through the mouth almost impossible. Another article of import, "Ueber angeborne Enge und Verschluss der Lungenarterien-Bahn," was published in 1866.[17] In this paper he classified for the first time a large number of related cases which cause pulmonary insufficiency.

In the first volume of the *Deutsches Archiv für klinische Medicin*, Kussmaul and Maier described a disease of arteries (periarteritis nodosa), which had not been described theretofore. A second paper by

[16] *Ztschr. f. rationelle Med., Heidelb.* XXIII, 225.
[17] *Ibid.*, XXVI, 99.

the same authors appeared in the same journal,[18] entitled "Zur pathologischen Anatomie des chronischen Saturnismus." This paper was based on careful histological observations on the organs of a painter who died from lead poisoning. The poisoning resulted in an atrophy of the digestive glands, which hindered proper digestion; atrophy of the villi, which prevented proper absorption; and injury to the sympathetic ganglia, which resulted in a spasticity of the intestinal muscles.

Kussmaul published three papers on liver abscesses: "Ungewöhnlich grosse vereiterte Echinokokken-Geschwulst der Leber"[19] (in this case recovery resulted but a permanent fistula remained as a result of the puncture); "Zwei seltene Beobachtungen von tödtlich verlaufenen Leberabssessen"[20]; and "Eitrige Blennorrhoe mit sackiger Erweiterung der Gallengänge der Leber zu

[18] *Deutsche. Arch. f. klin. Med., Leipz.*, 1872, IX, 283.

[19] *Berl. klin. Wchnschr.*, 1867, No. 52, 543.

[20] *Ibid.*, 1868, No. 12, 129.

zahllosen abssess-ähnlichen Hohlräumen, hervorgerufen durch ein Konkrement im Ductus hepaticus."[21]

Two papers on thoracocentesis in cases of pleuritis appeared from Kussmaul's clinic: the first, by himself, on "Sechzehn Beobachtungen von Thorakocentesis bei Pleuritis, Empyem und Pyopneumothorax,"[22] and the other by Dr. F. Vogel, entitled "Eine neue Methode zur Entleerung des Eiters nach Thoracocentese."[23] They inserted a double tube or U-tube into the pleural cavity. Rubber tubes were connected with each projecting tube. The one was connected with a pressure bottle containing a mild disinfecting solution which was allowed to flow into the pleural cavity, and the other led into a vessel which received the fluid from the pleural cavity. Kussmaul claimed that this method was much more effective than drainage from a single tube. It is of interest to note that in the treatment

[21] *Ibid.*, 1868, Vo. 20.

[22] *Deutsches Arch. f. klin. Med.*, Leipz., 1868, IV.

[23] *Berl. klin. Wchnschr.*, 1869, No. 46 and 47.

of empyema at the present time the drainage method is advocated and employed.

In 1868 he published a paper entitled "Epidemie durch Vergiftung mit Schwartenmagen in Lahr und Umgebung."[24]

The work which brought Kussmaul great popularity at the time was the use of the stomach tube in cases of enlargement of the stomach as a result of pyloric constricture or closure. He reasoned that the pyloric constriction resulted from the excessive stimulation of the sympathetic nerves by the sour content of the stomach. He cites a case where cure was effected by emptying the stomach daily and washing it with bicarbonate of soda. In long-standing cases with complete or almost complete closure he was unable to effect a cure. That Kussmaul was not the originator of the stomach pump, as the Germans claim, is discussed earlier in this paper. The splendid results, however, and the analysis of when the stomach tube should be used and when it should not be used, which Kussmaul has

[24] *Deutsche. Arch. f. klin. Med.*, Leipz., 1868, IV.

given, have without question been instrumental in bringing the method into more general use. Kussmaul realized that many stomach disorders, and especially pyloric closures, could not be cured by the use of the stomach pump alone, but he suggests:

It may be that the keener intellects of future generations will undertake in such case to resort to gastrotomy, stomach fistula, enlargement of the pyloric opening by means of a knife or tube, in order to obtain radical results. Who would dare to answer this question today? I fear that even this suggestion may elicit secret or open ridicule.

Closely associated with his work on the stomach stand his observations of the esophagus and stomach with the esophagoscope and gastroscope. No paper was published on this subject although he read several papers on it before scientific organizations. He writes[25]:

During the winter session of our association, 1867–1868, I gave a talk on the local therapy

[25] *Deutsche. Arch. f. klin. Med.*, Leipz., 1869, VI, 456.

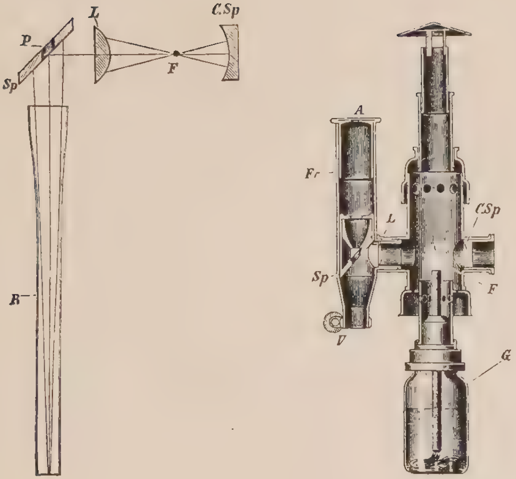
of the oesophagus and stomach, partly with reference to this new method of cure [the use of the stomach pump] and partly in the form of a demonstration of the oesophagoscope and gastroscope, on which subject I shall write later.

This latter wish was never fulfilled. The statement, however, is the first on record relative to the successful use of the gastroscope.

Dr. Gustav Killian in his history of the esophagoscope and gastroscope gives an interesting account of Kussmaul's place in the history of the use of this instrument. Killian had access to the instrument which Kussmaul used and to the esophagoscopic drawings which Kussmaul had made. Both of these are shown in the accompanying pictures. He also corresponded with Dr. Kussmaul freely and thus obtained first-hand information regarding this subject. According to Killian, the story of Kussmaul's relation to the history of gastroscopy is as follows: Optical instruments, which might be called endoscopes, date back to Bozzini (1805), Buchanan (1825), Segalas

(1826), Kramer (1833), Bonafont (1834), and James Gregory (1861). On November 29, 1853, Desormeaux demonstrated a urethroscope which he called the endoscope He used this instrument exclusively for examining the urethra and bladder and suggested its use in rectal and vaginal examinations. In 1865, Cruise[26] suggested that it might be used in the examination of the esophagus and stomach. In 1868, Kussmaul began his studies on the digestive tract. In order to learn something about the endoscope Kussmaul sent his assistant, Dr. Honsell, to Desormeaux at Paris to get one. Killian states that this instrument may still be found complete in the clinic at Freiburg. Dr. Kussmaul used it in studying the esophagus with success. He was able to see with great clearness a carcinoma at the upper end of the esophagus in one of his patients. It happened that at the time a man who was able to swallow a small sword gave demonstrations at Freiburg. Kussmaul brought this sword-eater into his clinic and

[26] *Dublin Anat. J. Med. Sc.*, 1865, XXXIX.



a *b*

The Esophagoscope Which Kussmaul Used. (Désormeaux's Endoskop nach Originalabbildungen. *a:* *F*, Flamme; *C.Sp*, Concavspiegel; *L*, Planconvexlinse; *Sp*, Planspiegel bei *P* in der Mitte durchbohrt; *R*, Röhrenspeculum. *b:* *G*, Lampe, in fester Verbindung mit dem Concavspiegel (*C.Sp*) und der Sammellinse (*L*); um die optische Achse dieses Systems ist das Fernrohr (*Fr*) mit dem centraldurchbohrten, ebenen Reflexspiegel (*Sp*) drehbar; *V*, Befestigsstelle der Röhrenspecula.)

had him swallow the long tube of the endoscope. Kussmaul, thus, is the first on record to use a gastroscope. The light, however, being so far removed from the stomach, was not sufficient to make the observation of practical value.

Of historical interest are Kussmaul's twenty popular letters on "Menschenpocken und Kuhpockenimpfung" which were published in the *Freiburger Zeitung* during the winter of 1869. In such an interesting and explanatory manner did he write these letters that a much greater tolerance toward vaccination resulted, and the present low death-rate from smallpox cases in Germany is attributed to this educational campaign.

During the years 1868–1872, Kussmaul reviewed the subject of "Diseases of the Nervous System" in the "Virchow-Hirsch'schen Jahresberichten." In addition he published four other articles. Two of these appeared in the *Berliner klinische Wochenschrift;* the first, "Ueber rheumatischen Tetanus und rheumatischtonische Krämpfe,

welche mit Albuminurie verlaufen,"[27] and the second, "Zur Lehre von der Tetanie."[28] The third was "Traumatisch-rheumatischen Tetanus in einer bis jetzt wenig beachteten Abortivorm"[29] and the fourth, a masterpiece entitled "Ueber die fortschreitende Bulbärparalyse und ihr Verhältniss zur progressiven Muskelatrophie."[30]

In his article "Ueber schwielige Mediastino-Pericarditis und den paradoxen Puls,"[31] Kussmaul describes various types of pericarditis. Among his cases, he reports three were due to mediastinal adhesions. The arch of the aorta was compressed at each inspiration, which resulted in a diminution or omission of the pulse while the heartbeat was regular. With each expiration the pulse was normal. Kussmaul writes: "I propose to call this the paradoxical pulse." An earlier observation of such a pulse was

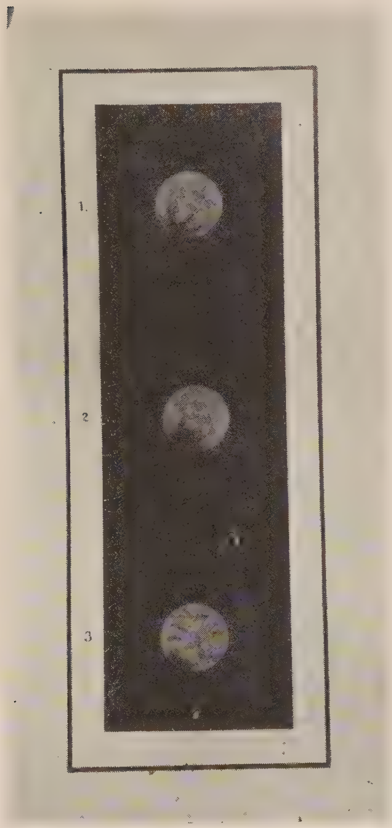
[27] 1871, VIII, No. 41–44.

[28] 1872, No. 37.

[29] *Deutsches Arch. f. klin. Med.*, Leipz., II.

[30] *Samml. Klin. Vortr.*, Leipz., No. 54, 1637.

[31] *Berl. klin. Wchnschr.*, 1873, x, No. 37, 38, 39.



Kussmaul's Drawings of Esophagoscopical Pictures.

made by Griesinger and described by Widenmann in 1856.

The last of his publications from Freiburg, "Zur Lehre vom Diabetes mellitus," appeared in 1874.[32] Among the symptoms which he noted in this disease was the peculiar respiration which is still known as the "Kussmaul respiration" or the respiration of diabetic coma. The usual description of this respiration is not the same as that given by Kussmaul. The following is a translation of part of Kussmaul's own description as it appeared in 1874:

A Peculiar Type of Dyspnea. In this type of dyspnea there is not the least suggestion as is so common in all other types, that the passage of air to or from the lung has to combat obstruction in its path; to the contrary it passes in and out with the greatest of ease. The thorax expands noticeably in all directions without a pulling-in of the lower end of the sternum or the costal interspaces (In the last hours of life when I could no longer examine the patients it may have been different), and

[32] *Deutsches Arch. f. klin. Med.*, Leipz., 1874, XIV.

this complete inspiration is followed by a likewise complete expiration. In the deepest parts of the lung one can notice a perfectly clear, loud and distinct *Vesiculärathmen* (sogen. pueriles Athmen); and yet everything is indicative of extreme air hunger, such as the discomfort of angusty of which the patient complains, the extreme activity of the respiratory muscles, and the loud noise that the powerful inspirations and more so the expirations make as the air passes through the larynx. A true stridor, however, never exists. The sibilant sound of a stridor occurs only in stenosis of either the traches or larynx. To the contrary the noise of expiration often becomes a groan even when the patient lies unconscious in deep coma. . . . In spite of the great discomfort of angusty the dyspnea never becomes orthopnea even though the sick are too weak to hold themselves upright. The marked contrast between the extreme general weakness of the patient and the powerful respiratory movements is a striking peculiarity of this picture.

He described the final clinical picture but was at a loss to know what was the cause of these symptoms. In this con-

nection he studied the effect of acetone on rabbits and on man. He found its action not as intense as chloroform or ether but stronger than alcohol. He noted that it is, to a considerable extent, exhaled unchanged. In man he found that large doses could be given without poisoning. He, therefore, questioned the view that the final symptoms could be regarded as acetone poisoning. He does, however, say that the constant presence of acetone may produce acute symptoms, just as in chronic alcoholism acute "delirium tremens" may appear suddenly.

In 1876 Kussmaul was called to Strassburg. His first literary product from Strassburg was a book: "Die Störungen der Sprache."[33] This is considered by many the most masterly of all his productions.

During his ten-year stay at Strassburg, Kussmaul's activities resulted in two further papers on the stomach, published in 1879 and 1880; three on neuropsychiatric subjects, 1880, 1882 and 1887; and one on fibro-purulent infection of Stenson's duct. He

[33] Leipzig, 1877.

also published two papers, one in memory of Dr. Benedict Stilling (1879) and the other in memory of Nikolaus Friedreich (1883).

In 1888 Kussmaul returned to Heidelberg as Professor Emeritus. His intention was to give his overworked body the long-looked-for rest. He obtained a very comfortable house but not the desired retirement from practice. People from all parts of Germany who suffered from chronic ailments came to him, and he did not have the heart to turn them away. Oftentimes his work kept him from his prescribed walks, diversions and meals.

In spite of this work he found time to continue his literary activities. In 1897 he wrote a booklet: "Ueber den kommissarischen Entwurf zur Revision der deutschen medizinische Prüfungsordnung."[34]

Kussmaul's spare time at Heidelberg was spent in writing his exceptionally fine autobiography, entitled "Jugenderinnerung eines alten Arztes."[35] A continuation of

[34] Heidelberg, 1897.

[35] Stuttgart, 1899.

Adolf Kussmaul on his Death Bed.

this autobiography, entitled "Aus Meiner Dozentenzeit," was never completed, but was published after his death by Vinzenz Czerny. His last strictly scientific publication appeared in 1900: "Ueber lange fortgesetzte Anwendung kleiner Digitalisgaben."[36] In January, 1902, several months before his death, his last article appeared, entitled "Ein Dreigestirn grosser Naturforscher an der Heidelberger Universität im 19 Jahrundert."[37]

Kussmaul was very fond of poetry and in his earlier years enjoyed writing it. During his academic life he found no time to exercise his poetic talent. Even his earlier poems had been mislaid. When, therefore, in his later years, he found his poems among old books, he was greatly rejoiced and had them published under the title of "Poetische Jugendsünden des Dr. Oribasius," and gave them as Christmas gifts to his friends in 1893.

While Kussmaul did not write many poems in his old days, the Foreword to

[36] *Therap. d. Gegenwart.*, January, 1900, p. 1.

[37] *Deutsch. Rev.*, Stuttgart, 1902.

his Autobiography shows that he still had the ability:

> Muszt du Gram im Herzen tragen
> Und des Alters schwere Last,
> Lade dir aus jungen Tagen
> Die Erinnerung zu Gast.

Translated:

> If in your heart you must sorrow bear
>   And the burden of old age days
> Invite as the guest for your burden to share
>   The remembrance of your youthful ways.

That this Foreword conveys the mood of Dr. Kussmaul at the time of preparing his autobiography can be appreciated when we remember that his wife died shortly before he began writing it.

On February 22, 1902, Kussmaul celebrated his eightieth birthday. For this occasion clinical men and physicians from all parts of Germany, who had associated with Kussmaul, decided to dedicate Volume LXXIII of the *Deutsches Archiv für klinische Medicin* to him. This volume contains contributions from thirty-three different workers, and all of the articles have some

reference to one or the other of Dr. Kussmaul's own researches. On this occasion the municipality of Heidelberg presented him with the freedom of the city, and the Grand Duke of Baden granted him the Title of Real Privy Councilor.

In the early morning of May 28, 1902, Dr. Adolf Kussmaul, after a half hour's struggle with death, was numbered in the toll of the Grim Reaper. Coronary sclerosis was the cause of his death. Kussmaul was active and retained his mental vigor to the last hours of his life, although the burden of eighty years rested heavily upon him at times. In his death all those who knew him lost a friend of kindly and amiable disposition and the medical world a leader and investigator of high rank.

SUMMARY OF KUSSMAUL'S LITERARY WORKS

A. Akademische Preisschrift

1845. Die Farbenerscheinungen im Grunde des menschlichen Auges. Heidelb.

B. Als praktischer Arzt

1847. Ein Fall von spontanen, anhaltenden Hamorrhagien in den Bauchfellsack, mit Bildung von Geschwulsten. *Ztschr. f. rat. Med.*, Heidelberg, VI, 92–101.

1852. Zur pathologischen Anatomie des Rheumatismus ac. articulorum. *Arch. f. physiol. Heilk.*, Stuttg., XI, No. 4. Zwei Fälle von Polyostitis bei Knaben, einen Fall mit Ausgang in Nekrose der Knochen und Genesung, der andere mit Perikarditis und Ausgant mit Tod.

(Wohl die erste Beschreibung der akuten Osteomyelitis, da Chassaignacs Memoire sur l'osteomyelite erst 1854 erschienen ist. Czerny.)

1853. Belege zur Kontagiosität der Ruhr nebst einigen Bemerkungen über ihre Therapie. *Mitth. d. badisch. ärztl. Ver.*, Karlsruhe, VII, No. 2.
1853. Stomatitis septica. *Ibid.*, VII, No. 8.
1853. Erfahrungen über den Abdominaltyphus in der Umgebung von Kandern in den Jahren 1850–1853. *Ibid.*, VII, No. 13.
1854. Bemerkungen über die Bedeutung des Nasenblutens, besonders im Typhus. *Ibid.*, VIII, No. 23.

C. Doktordissertation

1855. Untersuchungen über den Einfluss, welchen die Blutströmung auf die Bewegungen der Iris und anderer Theile des Kopfes ausübt. Diss. inaug. *Verhandl. d. phys.-med. Gesellsch. in Würzb.* VI, 1–42.

D. Als Lehrer der Heidelberger Hochschule

1856. Über die Totenstarre und die ihr nahe verwandten Zustande von Muskelstarre mit besonderer Rücksicht auf die Staatsarztneikunde. *Prag. Vierteljahrsschr.*, XIII, 2.
1857. Über den Einfluss der Blutströmung in den grossen Gefässen des Halses auf die Warme des Ohrs beim Kaninchen und ihr Verhältniss zu den Warmeveranderungen, welche durch Lahmung und Reizung des Sympathikus

bedingt werden. *Untersuch. z. Naturl. d. Mensch. u. d. Thiere.* I, 90.

1857. Untersuchungen über Ursprung und Wesen der fallsuchtartigen Zuckungen bei der Verblutung. With A. Tenner. *Ibid.*, III, I, and Frankfurt a. M.

1857. Ein Fall von wahrscheinlicher Morphinvergiftung. *Deutsche Ztschr. f. d. Staatsarztneikunde.* IX, 2.

1857. Über einige Bestandteile des Fliegenschwamms. With Dr. Borntraeger. *Verhadl. d. naturh.-med. Ver. zu Heidelb.* I, 18.

1858. Über die Zerreissung der inneren Haute der Halsarterien bei Erhängten. *Virchow's Arch. f. path. Anat.* [etc.], Berl., XIII, 60.

1858. Über die Ertotung der Gliedmassen durch Einspritzung von Chloroform in die Schlagadern. *Ibid.*, XIII, 289.

1859. Von dem Mangel, der Verkümmerung und Verdopplung der Gebärmutter, von der Nachempfängniss und der Ueberwanderung des Eies. Würzburg. 8vo, viii + 384 pp.

1859. Untersuchungen über das Seelenleben des neugeborenen Menschen. Leipz. & Heidelberg.

1859. Zwei Fälle von Paraplegie mittö dtlichem Ausgange ohne anatomisch nachweisbare oder toxische Ursache. Programm zum Eintritt in die mediz. Facultät der Universität zu Erlangen. Heidelberg.

E. Als innerer Kliniker in Erlangen

1861. Untersuchungen über den constitutionellen Mercurialismus und sein Verhältniss zur constitutionellen Syphilis. Würzburg. 433 pp.

1862. Über geschlechtliche Frühreife. *Würzb. med. Ztschr.*, III, 321.

1862. Weitere Beitrage zur Lehre von der Uberwanderung des menschlichen Eies. *Monatschr. f. Geburtsk.*, XX, No. 4, 295.

1863. Beitrage zur Anatomie und Pathologie des Harnapparats. *Würz. med. Ztschr.*, IV, 24.

1. Über die Diagnose der Phthisis tuberculosa der Harnwege.
2. Markschwamm der linken Niere bei einem 3½ J. alten Knaben.
3. Hydronephrosis durch Kreuzung des rechten Ureter mit einer uberzahligen Nierenarterie.
4. Hydronephrosis mit ungewohnlicher Ausdehnung der Niere.
5. Morbus Brightii mit ungewohnlich langer, mehr als zehnjahriger Dauer.
6. Zur Lehre von der Paraplegia urinaria.
7. Zellen mit kernahnlichen und schleimkorperahnlichen Gebilden in ihrem Inneren bei Blasenkatarrh einer Ikterischen. Gallenfarbstoff-Kristalle in diesen Zellen und den Schleimkorperchen des Sediments. Anhang: Morbus Addisonii.

1864. Rheumatismus articularis acutus mit Tuberculosis miliaris. Wanderung eines verschluckten Dorns in das Herz und ein freies Konkrement im Herzbeutel. *Ibid.*, v, 61.

F. Als innerer Kliniker in Freiburg i. Br.

1864. Zur Diagnose der Embolie der Arteriae mesentericae. *Ibid.*, v, 210.

1865. Über den Schnupfen der Säuglinge. *Ztschr. f. rat. Med.*, Heidelberg, s. 3, xxiii, 225. Auf Grund zahlreicher Untersuchungen seines Assistenzarztes, Dr. Honsell; an Sauglingen.

1865. Über angeborne Enge und Verschluss der Lungenarterien-Bahn. *Ibid.*, xxvi, 99–179, with 3 plates. Also: *Ber. d. naturhist. Gesellsch. z. Freiburg.*, iii, No. 3 and 4.

1866. Über eine bisher nicht beschriebene, eigentumbliche Arterien-erkrankung (Periarteritis nodosa), die mit Morbus Brightii und rapid fortschreitender allgemeiner Muskellahmung einhergeht. With Prof. Rud. Maier. *Deutsches Arch. f. klin. Med.*, Leipz., i, No. 484.

1867. Die Aschenbestandteile der Lungen und Bronchialdrusen, nach Analysen von Dr. phil. E. W. Schmidt. *Ibid.*, ii, No. 5, 89.

1867. Ungewohnlich grosse vereiterte Echinokokken-Geschwulst der Leber, durch Funktion

geheilt mit Zurücklassung einer Fistel. *Berl. klin. Wchnschr.*, No. 52, 543.

1868. Zwei seltene Beobachtungen von tödtlich verlaufenen Leberabssessen. *Ibid.*, No. 12, 129.
    1. Ein Leberlungenabssess, wahrscheinlich aus einer Echinokokken-Eyste hervorgegangen und wie Lungenphthise verlaufen.
    2. Pielfache Leberabssesse, aus eitriger Peripylephlebitis hervorgegangen, mit Absessen der Submucosa intestini coeci et coli und zwischen den Platten des Mesenterium. *Cf.*, Maier, R. *Arch. d. Heilk. v. Wagner*, 1867, No. 1, 30.

1868. Eitrige Blennorrhoe mit sackiger Erweiterung der Gallengänge der Leber zu zahllosen abssessahnlichen Hohlräumen, hervorgerufen durch ein Konkrement in Ductus hepaticus. *Berl. klin. Wchnschr.*, No. 20, 213.

1868. Sechzehn Beobachtungen von Thorakocentesis bei Pleuritis, Empyem und Pyopneumothorax. *Deutsches Arch. f. klin. Med.*, Leipz., IV, No. 1, 1; 173.

1868. Epidemie durch Vergiftung mit Schwartenmagen in Lahr und Umgebung. *Ibid.*, No. 5 and 6, 455.

1868. Am 21. Juli Vortrag "über Magenspiegelung" in der naturforschenden Gesellschaft zu Freiburg, der in deren Berichten angeführt, aber leider nicht ausführlich mitgeteilt ist.

1869. Ueber die Behandlung der Magenerweiterung durch eine neue Methode (mittelst der Magenpumpe). Freiburger Prorektorats-Programm zur Geburtstagsfeier des Grossherzogs Friedrich v. Baden. Im wesentlichen bereits vorgetragen 1867 in der 41. Versammlung deutscher Naturforscher und Ärzte in Frankfurt a. M. Abgedruckt im *Deutsches Arch. f. klin. Med.*, Leipz., VI, 455.

1870. Zwanzig Briefe über Menschenpocken und Kuhpocken-Impfung. Gemeinverständliche Darstellung der Impffrage. Freiburg i. B., viii + 117 pp.

1871. Ueber rheumatischen Tetanus und rheumatisch tonische Krämpfe, welche mit Albuminurie verlaufen. *Berl. klin. Wchnschr.*, VIII, 485, 497, 513, 525.

1872. Zur Lehre von der Tetanie. *Ibid.*, IX, 441.

1872. Zwei Fälle von spontaner allmählicher Verschliessung grosser Halsarterienstämme. *Deutsche Klinik.*, Berl. & Wien, No. 50, 51.

1872. Zur pathologischen Anatomie des chronischen Saturnismus. Gemeinsam mit Rud. Maier. *Deutsches Arch. f. klin. Med.*, Leipz., IX, 283.

1873. Ueber die fortschreitende Bulbärparalyse und ihr Verhältniss zur progressiven Muskelatrophie. *Volkmann's Samml. klin. Vortr.*, Leipz. (Innere Med.) No. 54, 1637–1674.

Cf. Maier, R. Ein Fall von fortschreitender Bulbärparalyse. *Virchow's Arch. f. path. Anat.* [etc.], Berl., LXI.

1873. Ueber schwielige Mediastino-Pericarditis und den paradoxen Puls. *Berl. klin. Wchnschr.*, X, 433, 445, 461.

1873. Über eine abortive Form des Tetanus. *Deutsches Arch. f. klin. Med.*, Leipz., XI, 1.

1874. Zur Lehre vom Diabetes mellitus. Über eine eigentümliche Todesart bei Diabetischen. Über Acetonamie. Über Glyzerin behandlung des Diabetes und Einspritzungen von Diastase ins. Blut bei dieser Krankheit. *Ibid.*, XIV, 1.

1877. Die Störungen der Sprache. Versuch einer Pathologie der Sprache. Supplement to Ziemssen. Handbuch der spez. Pathol. u. Therapie, Vol. XII. Leipz., Ed. 2. 1881, Ed. 3, 1885, 299 pp.

G. ALS INNERER KLINIKER IN STRASSBURG I. E.

1878. Über direkte Faradisierung des Magens. *Arch. f. Psychiat.*, Berl., VIII, 205.

1879. Anfallsweise auftretende Speichelgeschwulst in Folge von eitrig-fibrinöser Entzündung des Stenonschen Ganges (Sialodchitis Stenoniana fibrinosa chronica). *Berl. klin. Wchnschr.*, XVI, 209.

1879. Dr. Benedikt Stilling, Gedächtnisrede, gehalten auf der 52. Versammlung deutsche Natur-

forscher und Arzte zu Baden-Baden am 18. Sept. 1879. Selbstandig erschienen mit zahlreichen Noten der Professoren Dr. Goltz, Dr. Waldeyer und von Dr. Kussmaul selbst. Strassburg.

1880. Ein Fall von multiplen Gliomen in der Cerebrospinalaze unterhalb der Grosshirnschenkel. *Arch. f. Psychiat.*, Berl., XI, 261.

1880. Die peristaltische Unruhe des Magens, nebst Bemerkungen über Tiefstánd und Erweiterung desselben, das Klatschgeräusch und Galle im Magen. *Samml. klin. Vortr.*, Leipz., No. 181, 1673–1674.

1882. Über die Regulierung der Lautsprache durch den Tastsinn. *Arch. f. Psychiat.*, Berl., XIII, 712.

1883. Nikolaus Friedreich, gest. 6. Juli. 1882. Erinnerungen an ihn. *Deutsches Arch. f. klin. Med.*, Leipz., XXXII, 191.

1887. Demonstration von Nervenkranken auf der Wanderversammlung der Südwestdeutschen Neutrologen und Irrenärzte in Strassburg am 11. und 12. Juni 1887. Angeborne Athetose bei einem zehnjährigen Mädchen. *Cf.* Schaede, M. Über athetose. Diss. inaug. Strassburg, 1889. Kontraktur und Atrophie beider Unterschenkel nach Typhus bei einem erwachsenen Mädchen. *Arch. f. Psychiat.*, Berl., XIX, 289.

H. Als Professor Emerit. in Heidelberg

1897. Ueber den kommissarischen Entwurf zur Revision der deutschen medizinischen Prüfungsordnung. Heidelberg.

1899. Jugenderinnerungen eines alten Arztes. Stuttgart, Ed. 1, 1899; Ed. 11–13, 1922.

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